Washington State

Tuberculosis Epidemiologic Profile

2005

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Prepared by Alexia Exarchos, MPH
Infectious Disease & Reproductive Health
Assessment Unit
Division of Community and Family Health
Washington State Department of Health
(253) 395-6730

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EXECUTIVE SUMMARY

The Washington State Tuberculosis (TB) Epidemiologic Profile provides analysis and description of the TB disease burden in the state: incidence rates and relative risks for disease are calculated, disease distribution in sub-populations is described, risk factors are reported, and trends in TB are examined.

In 2005, Washington State reported 256 new cases of tuberculosis for a case rate of 4.0 per 100,000 persons, marking the end of a continued decrease in case rates since 1998. Twenty-three of 39 counties had at least one new case of TB. There were ten counties with five or more cases of TB. Among these, the five highest county-specific incidence rates were King (7.0), Yakima (5.6), Skagit (5.4), Snohomish (3.6), and Pierce (3.5).

The difference between gender-specific incidence rates did not reach statistical significance in 2005 (4.8 per 100,000 in males, 3.3 per 100,000 in females). Persons 65 years of age and older had the highest age-specific incidence rate, 7.7 per 100,000 population. Tuberculosis disproportionately affects minority populations: Asians had the highest incidence rate (25.6), followed by blacks (21.5), American Indians (18.4) and Hispanics (7). Sixty-seven percent of all cases of TB in 2005 were in persons born outside the United States. The largest proportion of foreign-born cases were Mexico (n=31), Vietnam (n=24), the Philippines (n=23), South Korea (n=14), and Ethiopia (n=13).

In 2005, five (2%) cases were diagnosed while living in a correctional facility; eight (3%) residents of long-term care facilities were also diagnosed with TB. Eight (3%) cases had a previous episode of active tuberculosis and 48% were considered unemployed when diagnosed. Co-morbidity with HIV/AIDS remains low in Washington State; only 6% of all TB cases were co-infected with HIV. Drug resistance was found in 36 (18%) of the 203 culture positive cases that had sensitivity testing done in 2005. Twenty-six cases were resistant to Isoniazid (INH). There were three Multi-Drug Resistant (MDR-TB) cases in 2005 and no Rifampin-only resistant cases as compared to 1 in 2004.

In 2002, an outbreak of TB was discovered among the homeless population in King County. A update of the outbreak as of May 2006 is provided in Appendix 1 of this profile. In 2004, an East African outbreak was discovered in King County. A description of the outbreak as of May 2006 is provided in Appendix 2 of this profile.

TUBERCULOSIS IN THE UNITED STATES

2005 National Highlights

After more than a decade of falling incidence rates, the rate of decline for persons with active TB in the United States is slowing. New surveillance data for 2005 show that 14,093 persons with active TB disease were reported in the United States, comparable to the 14,511 cases reported in 2004. In 2005, the national case rate for TB was 4.8 cases per 100,000 population, a slight decline of 2% in the case rate since 2004. The findings indicate that although the 2005 TB rate was the lowest recorded since national reporting began in 1953, the decline has slowed from an average of 7% per year (1993-2000) to an average of 4% per year (2001-2005).

During 2005, a total of 29 states and DC reported a decline in cases from 2004. Twenty states collectively reported 282 more cases for 2005 than for 2004.[1]

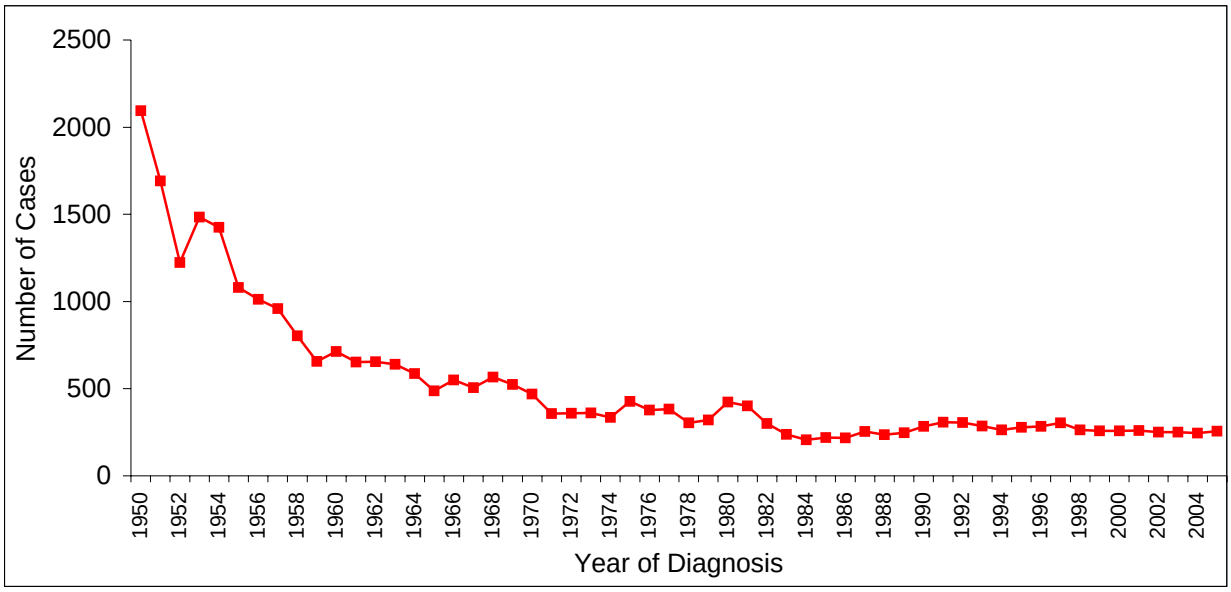
In contrast to the substantial decline in cases among U.S.-born persons since 1993, the number of cases reported among foreign-born persons has not changed substantially. From 1996 to 2000, the TB rate for foreign-born persons decreased 22%, from 32.6 to 25.3; from 2000 to 2005, the rate decreased 14%, from 25.3 to 21.8. More than half (56%) of the foreign-born cases in 2005 were reported in persons from Mexico (n=1,930), the Philippines (n=826), Vietnam (n=576), India (n=563), and China (n=389).

In 2005, for the second consecutive year, TB was reported more frequently among Hispanics than among any other racial/ethnic population. Of 3,164 Asians with TB and known origin of birth, 3,034 (96%) were foreign born; of 4,005 Hispanics with TB, 3,021 (75%) were foreign born; and, of 3,927 blacks with TB, 1,049 (27%) were foreign born. During 2003-2005, TB rates declined in almost all racial/ethnic populations; the decrease in rates was greatest in American Indian / Alaskan Natives (14%) and Asians (14%).

[1] Morbidity and Mortality Weekly Report (MMWR). Trends In Tuberculosis – United States, 2005. Morbidity and Mortality Weekly Report (MMWR), March 24, 2006 / 55(11); 305-308.

TUBERCULOSIS IN WASHINGTON STATE

Figure 1
Tuberculosis Morbidity, Washington, 1950-2005



Fifteen-Year State Trends

- The number of TB cases in Washington increased 25% from 1989-1991 and decreased 15% from 1991-1994. After a period of increased cases (1995-1997) the case count has declined 16% (Figure 2).
- In Washington, the TB incidence rate increased 17% from 1989-1991 and decreased 35% from 1991-2005 (Figure 3). Nationally, the TB incidence rate peaked in 1992 with 10.5 cases per 100,000 and decreased 54% to 4.8 per 100,000 in 2005 – the lowest national rate to date. National case rates have declined at a faster pace than incidence rates in Washington. Figure 3 shows a 54% decline in rates in the U.S. from 1992-2005 vs. a 35% decline in Washington from 1991-2005.

Figure 2
Number of Tuberculosis cases, Washington, 1989-2005

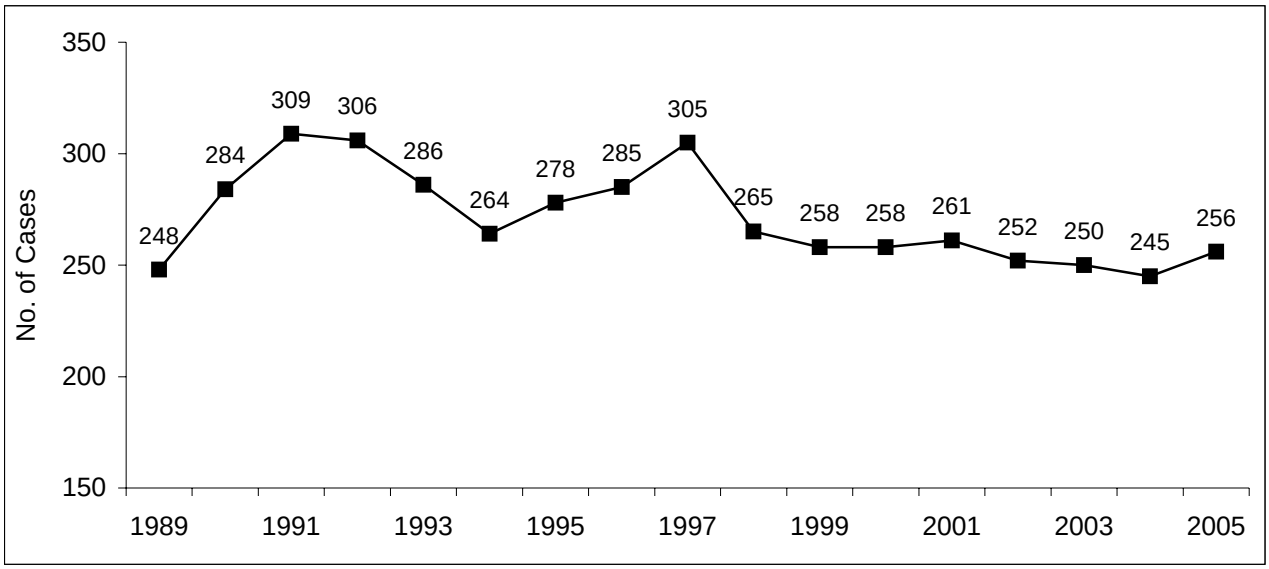
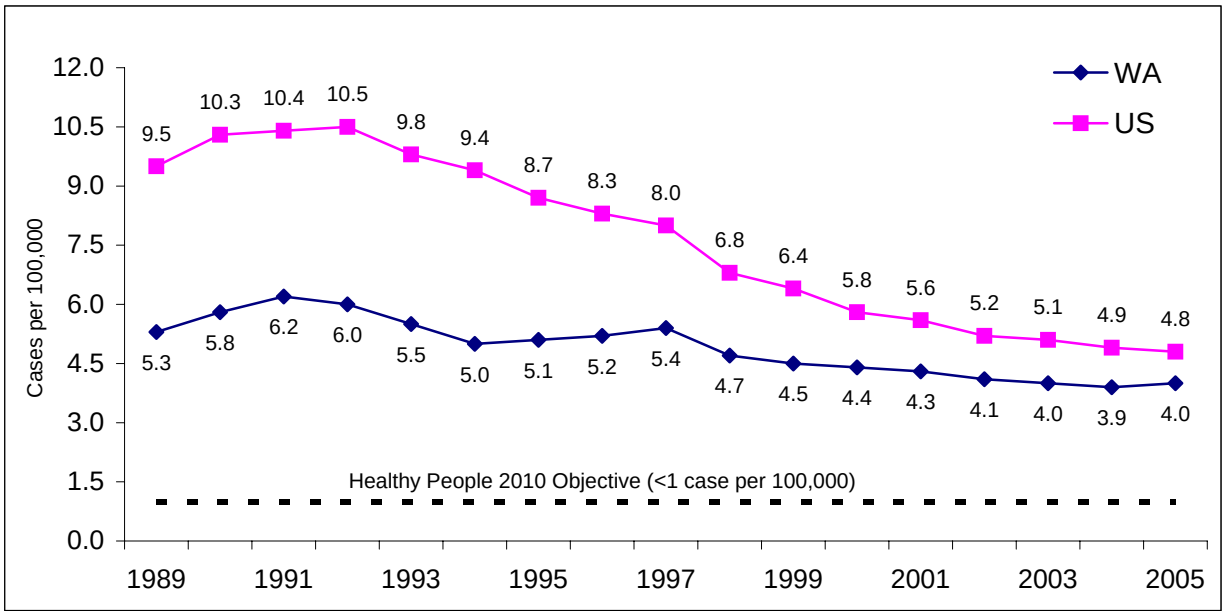


Figure 3
Tuberculosis incidence rates, Washington, 1989-2005

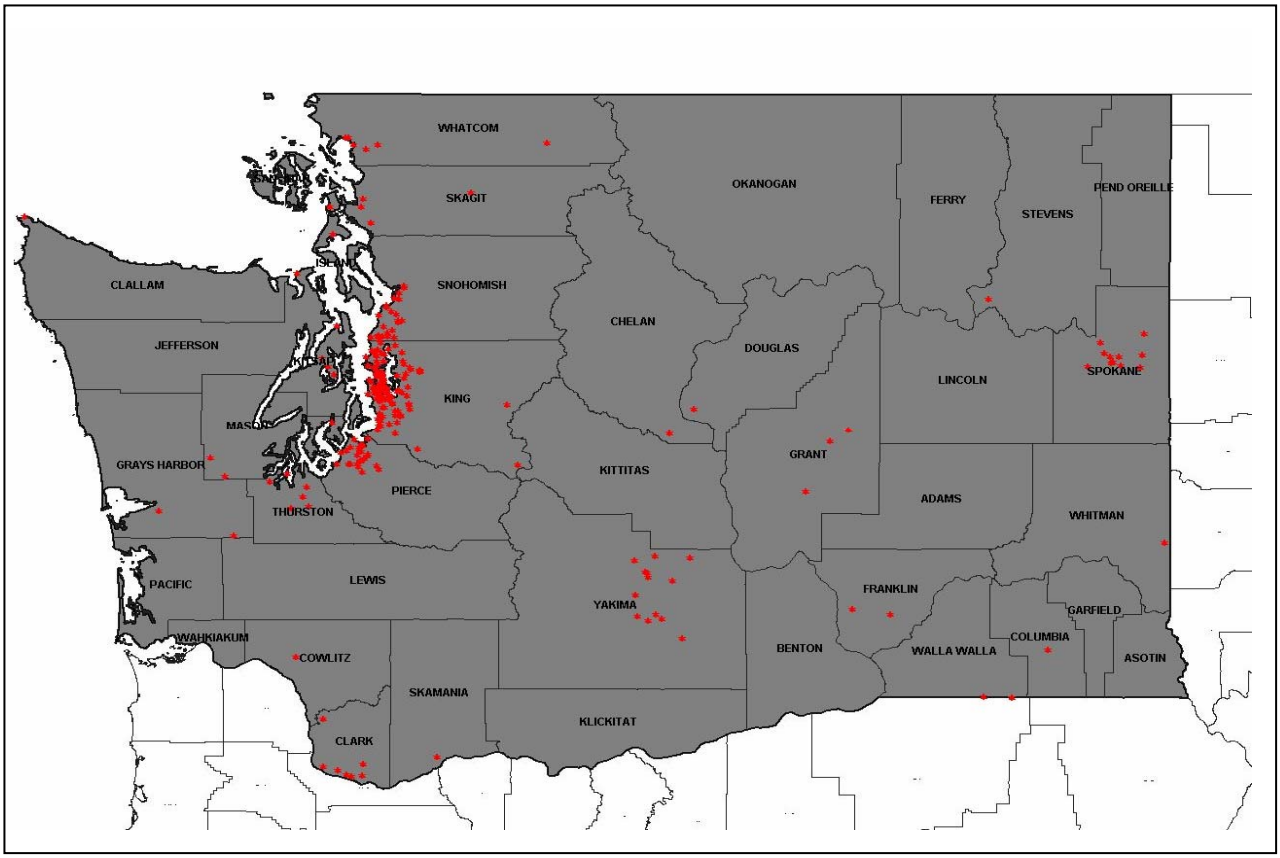


2005 State Highlights

- There were 256 new cases of active TB in 2005 indicating a 5% increase in the number of cases reported since 2004.
- The TB incidence rate was 4.0 per 100,000 population in 2005 marking a slight (2.3%) increase in case rates in Washington for the first time since 1997.
- Nationally, the TB incidence rate was 4.8 per 100,000 indicating a continued decrease in incidence rates since 1992 (Figure 3).

County Level Distribution

2005 Highlights



- Twenty-three of 39 counties reported at least one new case indicating a 21% increase in counties reporting TB cases since 2004 (Table 1). Most of the 10

counties that reported a new case of TB in 2005 and not in 2004, reported only 1 case.

- King County reported the highest number of cases (127), followed by Pierce (27), Snohomish (24), Yakima (14), and Spokane (13) counties (Table 1). These counties accounted for 80% of the total cases in 2005 while half (50%) occurred in King County alone.
- The incidence rate in King County was 7.0 per 100,000 (high); the combined incidence rate among Clark, Kitsap, Pierce, Skagit, Snohomish, Spokane, Thurston, and Yakima counties was 3.4 (medium); all other counties had a combined incidence rate of 1.7 per 100,000 (low) (Table 1).

Table 1.
Tuberculosis cases and incidence rates by county, Washington, 2005

County	Number of Cases	Incidence Rate
Chelan	1	-
Clark	9	2.1
Columbia	1	-
Cowlitz	1	-
Douglas	1	-
Franklin	2	-
Grant	3	-
Grays Harbor	3	-
Island	1	-
Jefferson	1	-
King	127	7.0
Kitsap	6	2.4
Pierce	27	3.5
Skagit	6	5.4
Skamania	1	-
Snohomish	24	3.6
Spokane	13	2.9
Stevens	1	-
Thurston	6	2.6
Walla Walla	2	-
Whatcom	5	2.7
Whitman	1	-
Yakima	14	5.6
State Total	256	4.0

Note: rates not calculated for cell sizes < 5.
Note: Counties not listed did not report any TB cases in 2005: Adams, Asotin, Benton, Clallam, Ferry, Garfield, Kittitas, Klickitat, Lewis, Lincoln, Mason, Okanogan, Pacific, Pend Oreille, San Juan, and Wahkiakum.

Five-Year County Trends

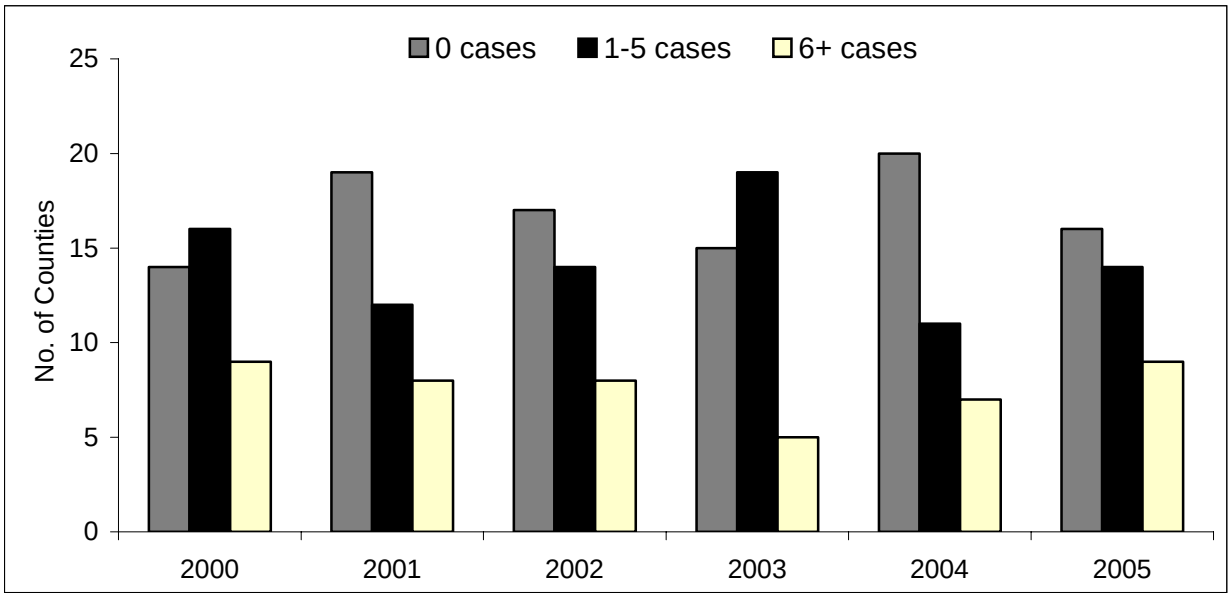
- Over the last five years most counties reported few cases of TB. Twenty-five counties reported fewer than five cases during this same time period (Table 2). In 2005, the number of counties reported a case of TB increased although the majority of these counties reported less than 5 cases of TB (Figure 4).
- Ferry, Garfield, Lincoln, Pend Oreille, and Wahkiakum counties have not reported a case of tuberculosis in the last five years.
- Only six counties had five or more cases of TB per year from 2000-2005: Clark, King, Pierce, Snohomish, Whatcom, and Yakima (Table 2).

Table 2.
Tuberculosis cases by county, Washington, 2001-2005

	2001		2002		2003		2004		2005	
County	**No.**	**Rate**	**No.**	**Rate**	**No.**	**Rate**	**No.**	**Rate**	**No.**	**Rate**
Adams	0	-	0	-	1	-	0	-	0	-
Asotin	0	-	0	-	0	-	0	-	0	-
Benton	1	-	1	-	2	-	4	-	0	-
Chelan	1	-	1	-	4	-	0	-	1	-
Clallam	0	-	0	-	1	-	0	-	0	-
Clark	8	2.2	10	2.7	10	2.6	8	2.0	9	2.2
Columbia	0	-	0	-	0	-	0	-	1	-
Cowlitz	2	-	2	-	1	-	0	-	1	-
Douglas	0	-	1	-	2	-	0	-	1	-
Franklin	2	-	3	-	5	9.3	3	-	2	-
Grant	7	9.9	2	-	3	-	0	-	3	-
Grays Harbor	3	-	1	-	1	-	1	-	3	-
Island	1	-	0	-	1	-	5	6.6	1	-
Jefferson	0	-	0	-	0	-	0	-	1	-
King	138	7.9	158	8.9	155	8.7	133	7.4	127	7.0
Kitsap	5	2.1	6	2.5	2	-	2	-	6	2.4
Kittitas	1	-	0	-	0	-	1	-	0	-
Klickitat	0	-	1	-	0	-	0	-	0	-
Lewis	0	-	0	-	2	-	1	-	0	-
Mason	4	-	0	-	3	-	1	-	0	-
Okanogan	0	-	1	-	2	-	0	-	0	-
Pacific	0	-	0	-	0	-	0	-	0	-
Pierce	22	3.0	16	2.2	18	2.4	34	4.5	27	3.5
San Juan	0	-	1	-	0	-	1	-	0	-
Skagit	1	-	3	-	2	-	2	-	6	5.4
Skamania	0	-	0	-	0	-	0	-	1	-
Snohomish	28	4.5	16	2.5	12	1.8	15	2.3	24	3.6
Spokane	10	2.3	7	1.6	4	-	7	1.6	13	2.9
Stevens	0	-	0	-	0	-	0	-	1	-
Thurston	5	2.3	3	-	5	2.3	7	3.2	6	2.6
Walla Walla	1	-	3	-	1	-	1	-	2	-
Whatcom	6	3.5	7	4.0	5	2.8	6	3.3	5	2.7
Whitman	0	-	1	-	0	-	0	-	1	-
Yakima	15	6.6	8	3.5	8	3.5	12	5.2	14	5.6
TOTAL	258	4.3	252	4.1	250	4.0	245	3.9	256	4.0

Note: rates not calculated for cases < 5; counties not shown did not report any TB cases over the past 5 years.

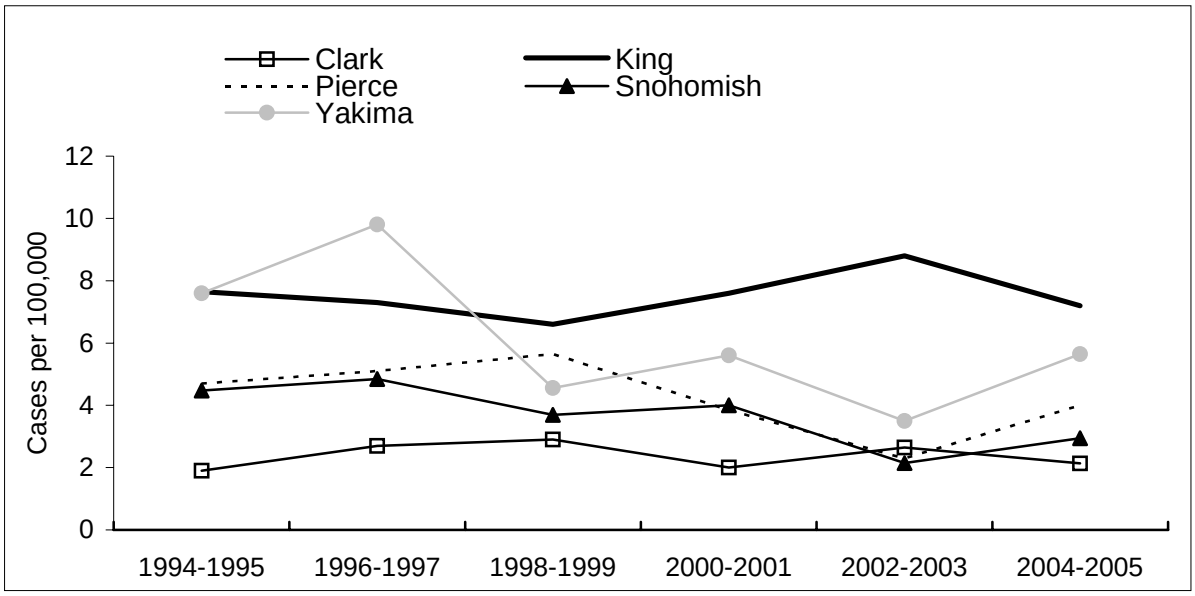
Figure 4
Number of counties by case number grouping, Washington, 2000-2005



Ten-Year County Trends

o Among counties with the highest case numbers over the past ten years, (Clark, King, Pierce, Snohomish, and Yakima) ten-year trends indicate slight increases in case rates among Pierce, Snohomish, and Yakima and a decrease in case rates among Clark and King counties (Figure 5). None of these changes were statistically significant.

Figure 5
Tuberculosis incidence rates for select counties, Washington, 1994-2005



Note: 2-Year averages were used to identify possible trends over time.

Age and Gender Distribution

2005 Highlights

- In 2005, persons age 45-64 years comprised the highest proportion of cases (32%) followed by those age 25-44 years (28%) (Table 3).
- Persons age 65 years and older continue to have the highest incidence rate, 7.7 per 100,000 (Table 3). Reasons for higher rates among the elderly include increased likelihood of infection earlier in life (early 1900s when TB transmission was more common) and age-dependent changes in underlying health that increases the risk for TB (e.g., immunosuppression, diabetes).
- Among all age groups, the gender-specific incidence rate continues to be slightly greater for males; however, none of these differences reached statistical significance (Figure 6). With increasing age, male/female differences increase, most likely due to behavioral factors linked to acquisition and reactivation of latent TB infection.
- In 2005, the difference between gender-specific incidence rates did not reach statistical significance (Figure 7).

Table 3
Tuberculosis cases by age group, Washington, 2005

Age	Rate	No.	(%)
0-4	0.9	4	(2)
5-14	0.5	5	(2)
15-24	4.1	37	(14)
25-44	4.0	72	(28)
45-64	5.1	83	(32)
65 and over	7.7	55	(21)

Figure 6
Gender and age-specific incidence rates (95% CI), Washington, 2005

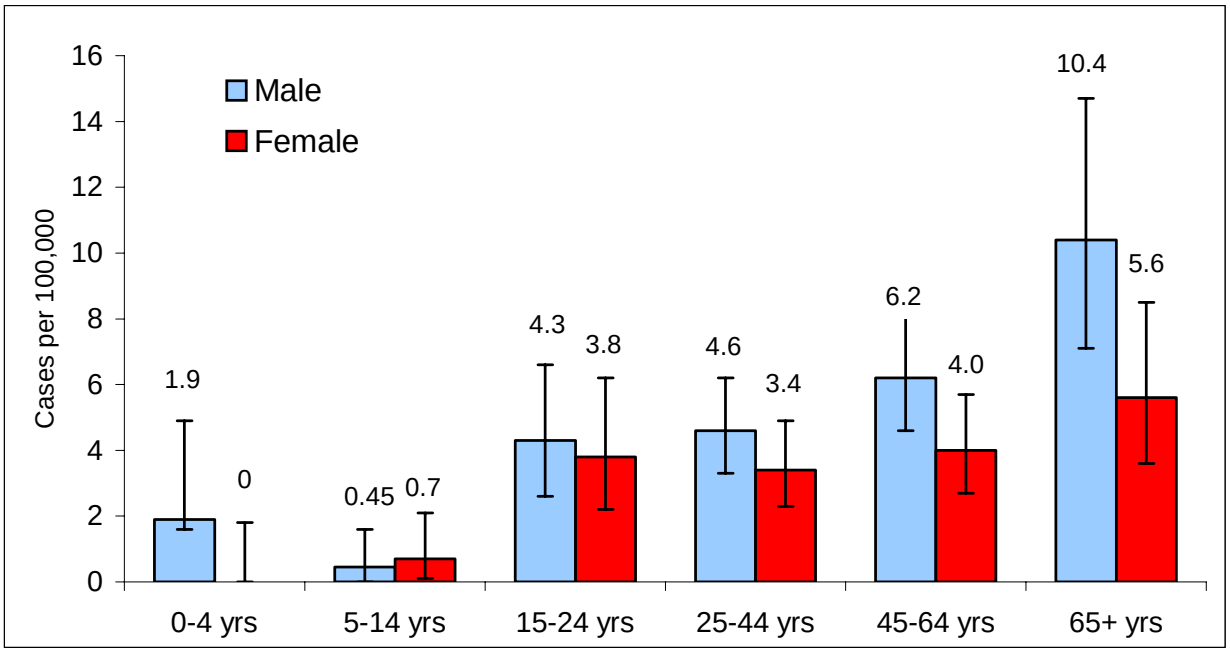
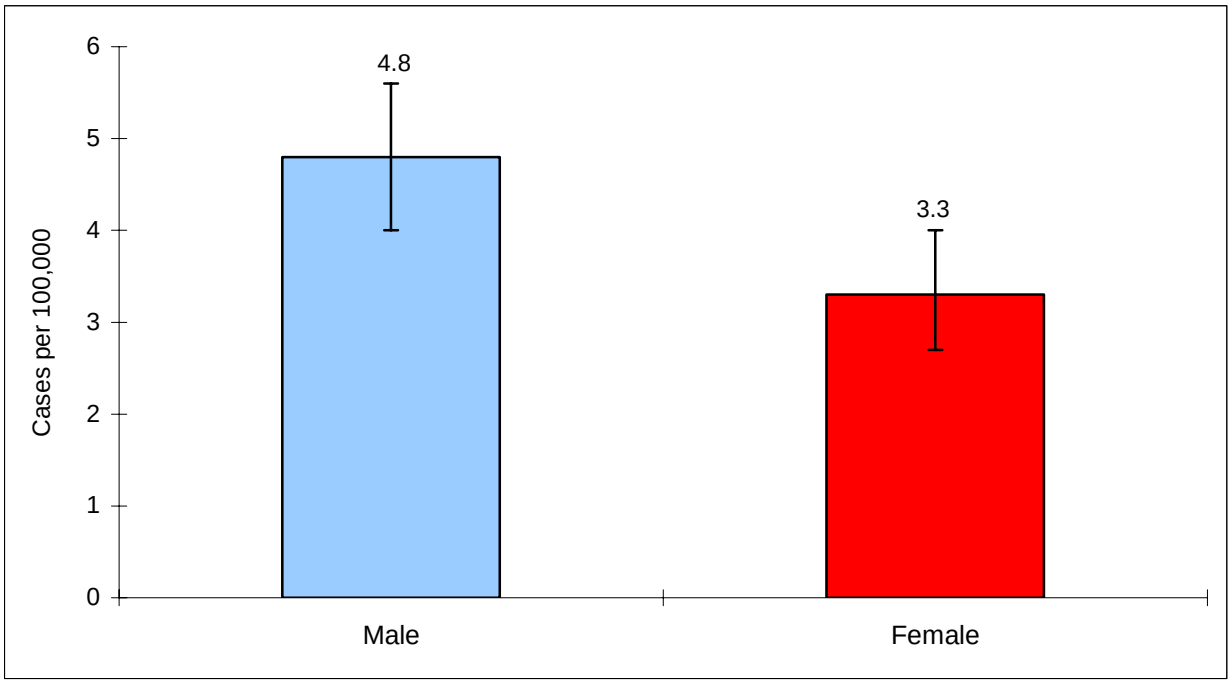


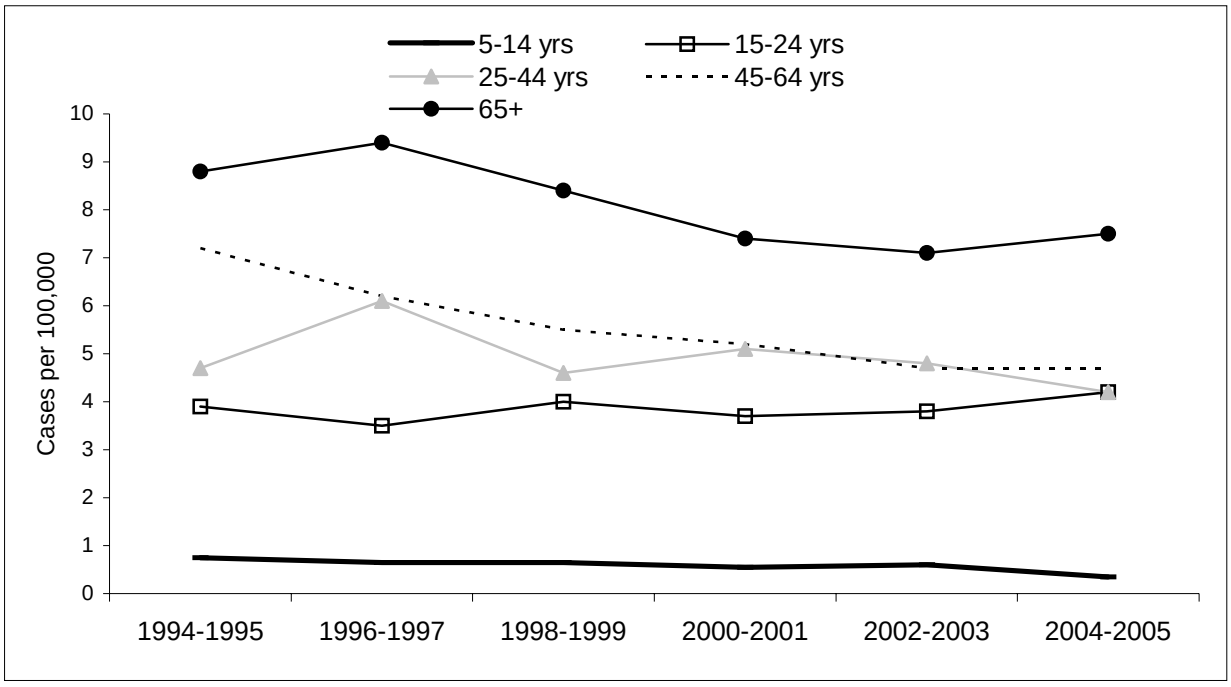
Figure 7
Gender-specific tuberculosis incidence rates (95% CI), Washington, 2005



Ten-Year Age and Gender Trends

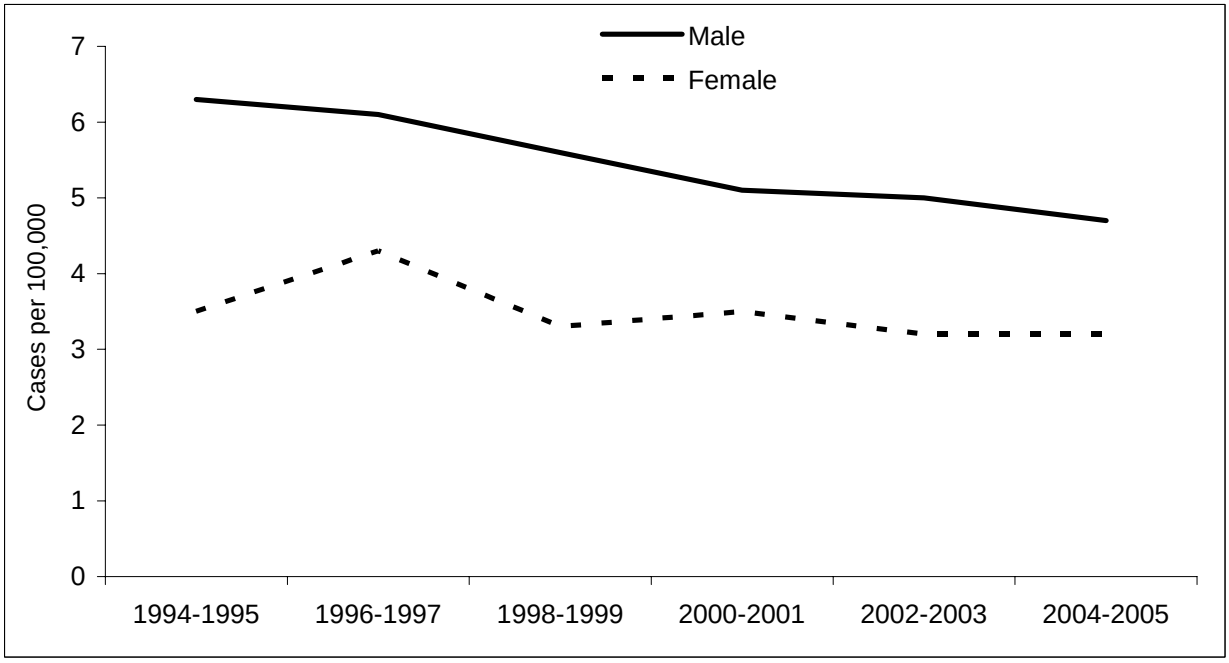
- A decreasing trend in TB rates was found across most of the age groups (Figure 8). However, because of low case numbers none of these decreases were significantly different.
- Persons age 5-14 years continue to have the lowest rates of TB in Washington (Figure 8).
- Gender-specific incidence rates have steadily decreased in males (6.8 in 1995 to 4.8 in 2005) and the previously seen difference between genders (2:1 in 1995) continues to narrow (Figure 9).

Figure 8
Age-specific incidence rates among select age groups, Washington, 1994-2005



Note: 2-Year averages were used to identify possible trends over time.

Figure 9
Gender-specific tuberculosis incidence rates, Washington, 1994-2005



Note: 2-Year averages were used to identify possible trends over time.

Distribution of Race/Ethnicity

2005 Highlights

- Certain racial and ethnic groups continue to be overrepresented in 2005. Asians had a case rate that was more than thirteen times higher than whites and almost four times higher than that of Hispanics. Blacks had a case rate eleven times higher than that of whites and three times higher than that of Hispanics.
- The proportion of cases among Asians and Hispanics remained unchanged in 2005 (39% and 14%, respectively) (Table 4). The proportion of cases increased slightly among American Indian and Alaskan Natives (7% in 2005 vs. 5% in 2004), and whites (36% in 2005 vs. 34% in 2004).
- In 2005, the majority (70%) of black cases were foreign-born and were primarily from Ethiopia (Table 4). This may be due in part to the East African outbreak in King County in 2005. Among whites, 47% were foreign-born and the majority were born in Mexico. Asian/Pacific Islanders comprised the largest proportion of cases in 2005 and most (94%) were born outside the U.S.

Figure 10
TB incidence rates by race/ethnicity, Washington, 2005

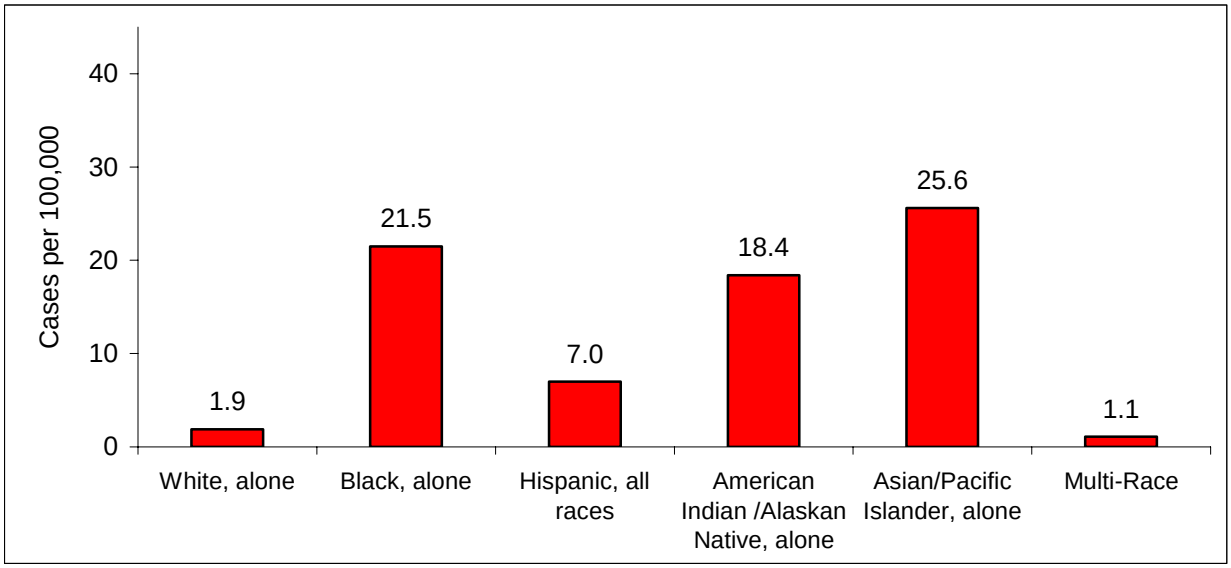


Table 4
Tuberculosis cases by race/ethnicity and country of origin, Washington, 2005

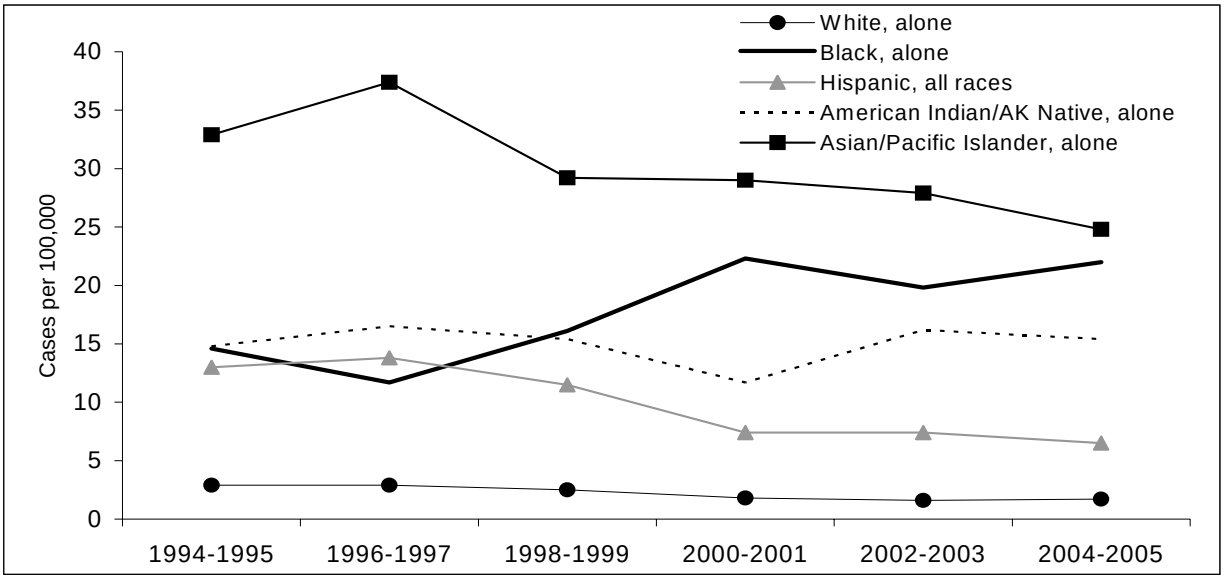
	U.S.-born		Foreign-born		TOTAL	
Race/Ethnicity	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**
White, alone	49	(53)	44	(47)	93	(36)
Black, alone	13	(30)	31	(70)	44	(17)
Hispanic, all races	3	(8)	34	(92)	37	(14)
American Indian/AK Native, alone	16	(94)	1	(6)	17	(7)
Asian/Pacific Islander, alone	6	(6)	94	(94)	100	(39)
Multi-Race	1	(50)	1	(50)	2	(1)

Note: The multi-race option was introduced in 2004.

Ten-Year Racial and Ethnic Trends

- Minority populations consistently have higher rates of TB than the state rate.
- Between 1997 and 2002 incidence rates among blacks increased (12.1 cases per 100,000 to 29.9 cases per 100,000) and may be on the rise again (Figure 11). The incidence rate among American Indians / Alaskan Natives has leveled and case rates among Asian Pacific Islanders continue to decrease (Figure 11).

Figure 11
Tuberculosis incidence rates by race/ethnicity, Washington, 1994-2005



Note: 2-Year averages were used to identify possible trends over time.

Country of Birth Distribution

2005 Highlights

- Sixty-seven percent (171 cases) of all tuberculosis cases in 2005 were among persons born outside the U.S. This remains unchanged from 2004. Foreign-born persons accounted for 63% (95/150) of male TB cases and 72% (76/106) of female TB cases. This corresponds to an estimated rate of 40-50 per 100,000, based upon a rough estimate of the resident foreign-born population in Washington State (350-400,000; 1996 INS estimated legal permanent residents at approximately 315,000). The rate among U.S.-born in Washington State is approximately 1.3 per 100,000 population.
- Almost half (49%) of all foreign-born cases came from Asia or Southeast Asia, followed by South America (19%), and Africa (16%) (Figure 13).
- The countries of origin for most foreign-born cases were Mexico (n=31), Vietnam (n=24), the Philippines (n=23), South Korea (n=14), and Ethiopia (n=13) (Data not shown).
- Foreign-born cases of TB were younger than U.S.-born cases because foreign-born populations tend to be younger than the overall state population and primarily originate from countries with endemic TB. Almost half (49%) of all foreign-born TB cases were between 15 and 45 years of age vs. 30% of U.S.-born cases within this same age group. Sixty-five percent of all U.S.-born cases were 45 years of age and older.
- Less than half (33%) of all foreign-born TB cases had been in the U.S. for less than five years (Table 5). Half (50%) of the cases had been in the U.S. 10 years or more.

Figure 12
Tuberculosis cases by gender and country of origin, Washington, 2005

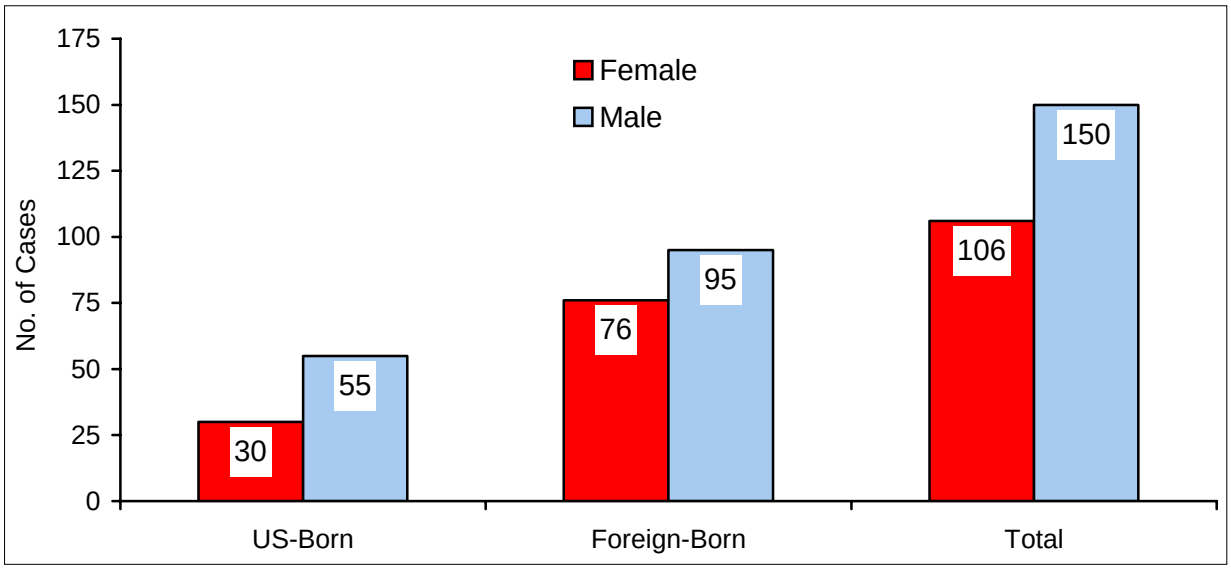


Figure 13
The number of foreign-born TB cases by geographic region, Washington, 2005

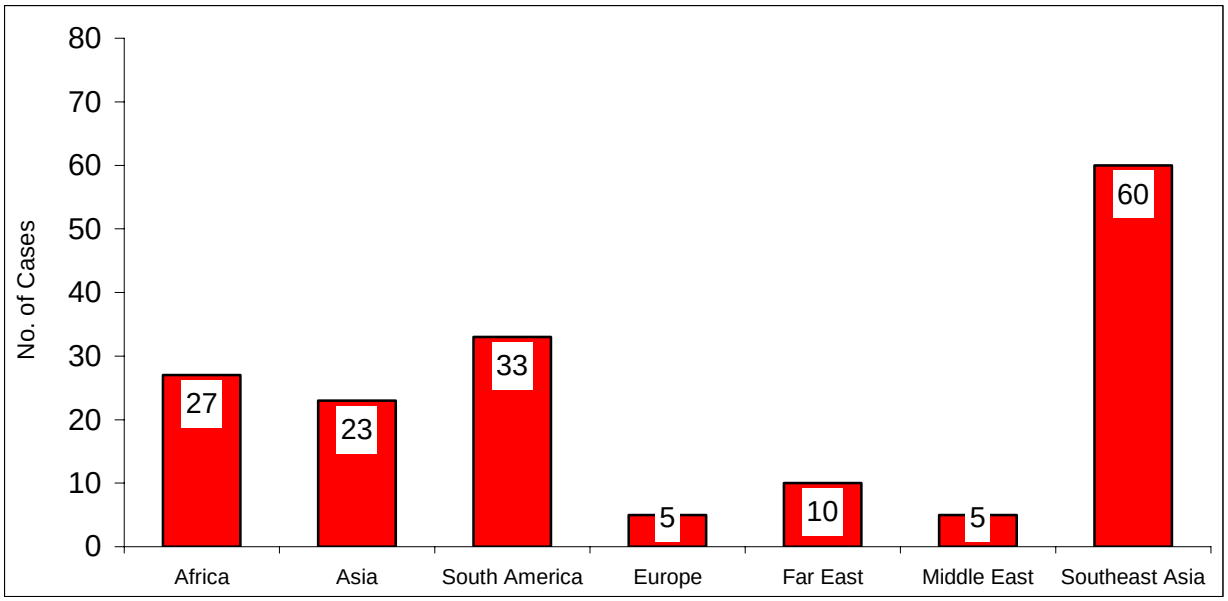


Table 5
Foreign-Born cases by age and length of time in the U.S., Washington, 2005

	Age					TOTAL	
Length of Time	**0-14**	**15-24**	**25-44**	**45-64**	**65+**	**No.**	**(%)**
Less than 1 year	1	1	3	1	1	7	(4)
1-4 years	2	18	10	11	5	46	(29)
5-9 years	-	7	10	4	7	28	(18)
10-19 years	-	4	17	10	8	39	(25)
20 years and over	-	-	7	19	13	39	(25)

Note: 12 missing responses.

Ten-Year Foreign-Born Trends

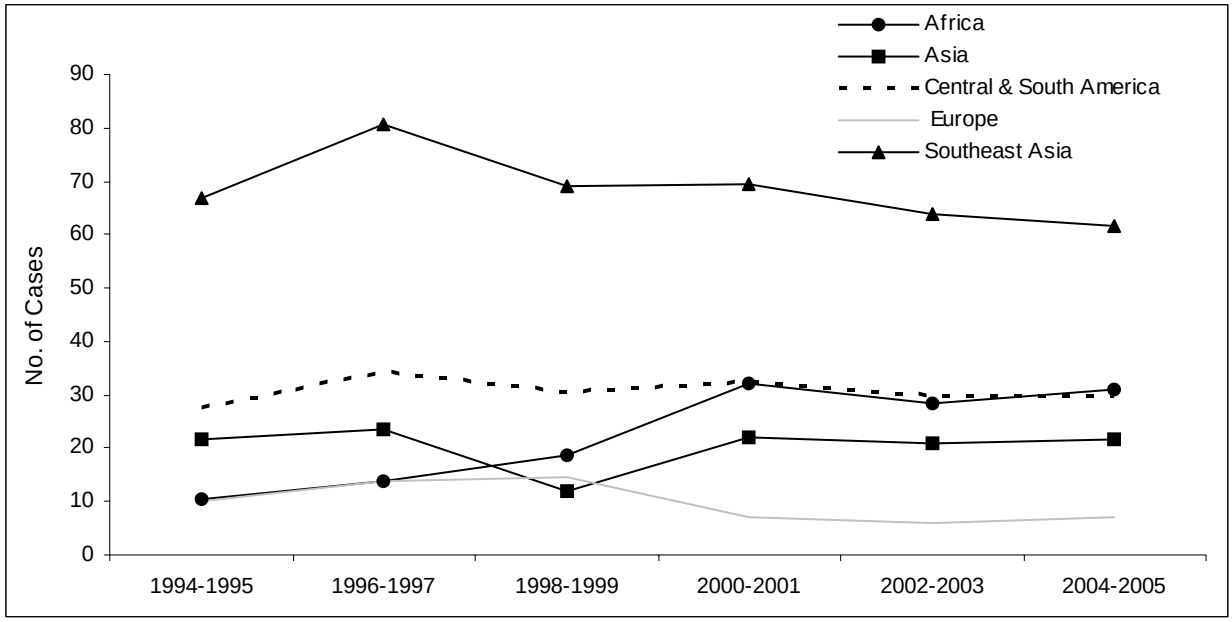
- Foreign-born cases from Southeast Asia comprised 42% of all foreign-born arrivals in the last ten years (Data not shown). Despite this, the number of Southeast Asian cases appears to have decreased over time (Figure 14).

- In the past ten years, a greater proportion of cases were among foreign-born persons (Figure 15). The gender distribution of U.S. and foreign-born cases differ; more females comprised foreign-born cases whereas more males made up U.S.-born cases over the past 10 years. In addition, the proportion of foreign-born cases has increased and remained over 50% since 1999.

- A shift in the number of cases between persons born inside the United States and those born outside has occurred since 1992 but this gap may be narrowing (Figure 16).

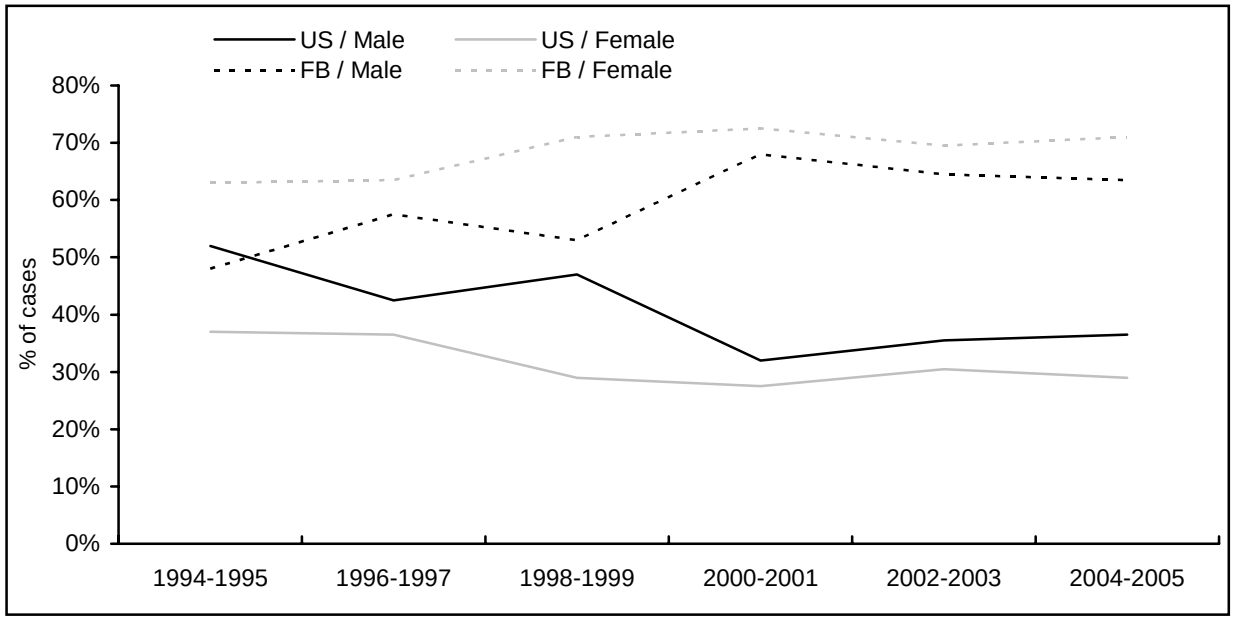
- From 1994-2001, the number of TB cases among foreign-born persons increased 32%. However, from 2001-2005 the number of cases among foreign-born persons decreased 9% (187 cases in 2001 vs. 171 cases in 2005). This decrease was mostly likely due to the TB outbreak among homeless persons in King County, which began in 2002 and was primarily comprised of U.S.-born cases (Figure 16).

Figure 14
The average number of cases by selected geographic regions among foreign-born populations, Washington, 1994-2005



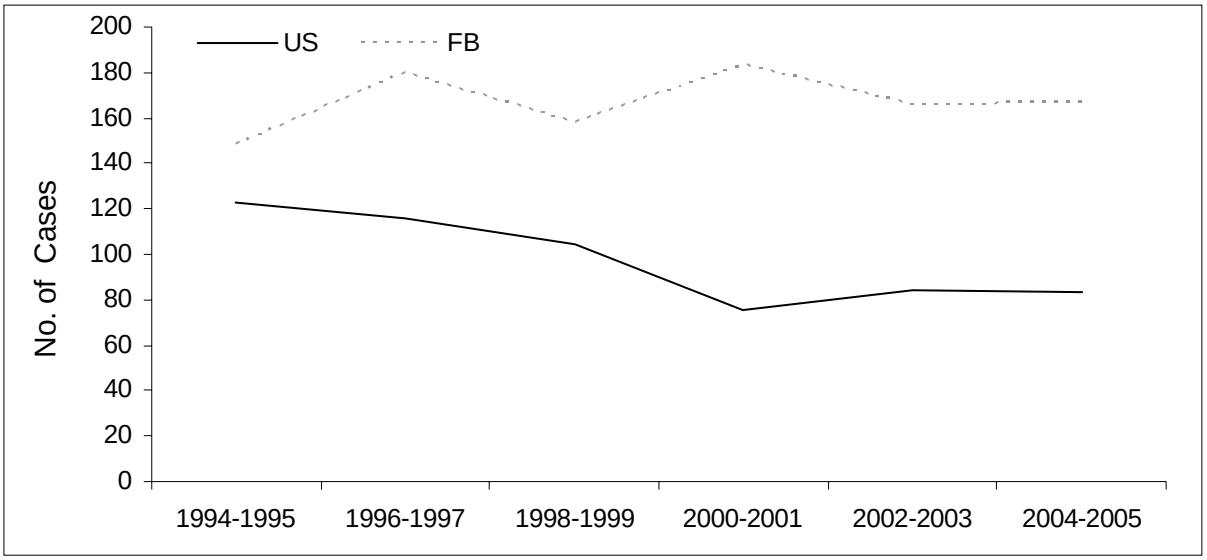
Note: 2-Year averages were used to identify possible trends over time.

Figure 15
Gender distribution of tuberculosis cases by country of origin, Washington, 1994-2005



Note: 2-Year averages were used to identify possible trends over time.

Figure 16
The average number of cases by country of origin, Washington, 1994-2005



Note: 2-Year averages were used to identify possible trends over time.

Risk Markers

- Nationally identified high-risk groups continue to present as part of TB morbidity in 2005.

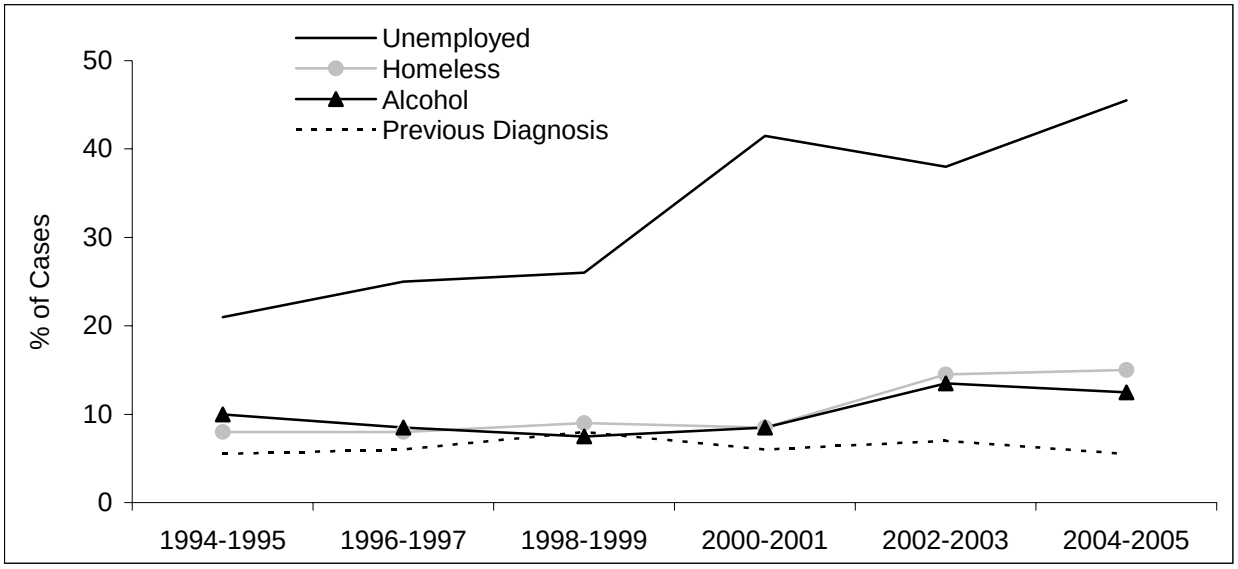
- Trends among selected TB risk factors indicate an increase in the proportion of cases reported as unemployed (in the last 2 years) (Figure 17). The proportion of cases reported as unemployed more than doubled from 23% in 1994 to 48% unemployed in 2005. This rise may be a result of improved reporting procedures from a homeless outbreak which occurred in King County from 2002-2004.

Table 6
Risk factors for tuberculosis, Washington, 2005

Risk Markers (# of months)	No.	(%)
Foreign-Born	171	(67)
Unemployed[a] (24)	124	(48)
Homeless (12)	40	(16)
Excess Alcohol	34	(13)
HIV/AIDS Positive	15	(6)
Other Drug Use[b] (12)	11	(4)
Injecting Drug Use[b] (12)	9	(4)
Health Care Worker (24)	10	(4)
Previous Diagnosis of TB	8	(3)
Resident of Correctional Facility[c]	5	(2)
Resident of Long Term Facility[c]	4	(2)
Migrant Worker (24)	5	(2)

[a]may include housewives and students; [b] may be underreported [c]at time of diagnosis.
Note: more than one risk factor may be identified.

Figure 17
Selected tuberculosis risk factors over a ten-year period, Washington, 1994-2005



Note: 2-Year averages were used to identify possible trends over time.

Close Contacts

- Among the 256 cases reported in 2005, 181 cases of pulmonary (adult and pediatric) TB and 3 pediatric cases of extra-pulmonary TB were eligible for contact investigation. There were 2,152 contacts identified for 65% of all eligible cases (120/184); marking a slight improvement from 2004 where contacts were identified for 63% of the eligible cases. An average of 17.9 contacts were identified per case with a range of 1 to197 contacts identified per case.

- Of the infectious TB cases (smear positive or a cavitary chest x-ray) in 2005 (n=97), 1,644 contacts were identified. The CDC recommends that at least 90% of close contacts to infectious TB cases receive examinations. Washington State surpassed this recommendation with 99% (1,623/1,644) of the contacts receiving initial examination.

- Washington created statewide TB objectives in 2005 to achieve by 2009.

    1. One such objective is that contacts will be identified for at least 90% of sputum AFB-smear positive TB cases. Of the 85 AFB smear positive cases in 2005, 73% (62/85) identified at least 1 contact which means that 23 possibly infectious cases (cases that reported as AFB smear positive) did not identify any contacts.
    2. Another objective is that at least 75% of contacts to sputum AFB-smear positive cases will be evaluated for infection and disease. There were 1,602 contacts identified to the 85 smear positive cases, 17% (268/1,602) of which were evaluated at the time of this report.

- Treatment of latent TB infection was started for 65% (230/354) of all infected contacts to infectious TB cases, marking a decrease in the initiation of treatment from 2004 (74%). Among infected contacts less than 15 years of age (n=25), 72% initiated treatment of latent TB infection, marking a decrease from 2004 (77%). Among infected contacts ages 15 and older (n=329), 64% initiated treatment of latent TB infection, marking a decrease from 2004 (74%).

- Among contacts that started therapy in 2004, 44% (134/301) completed treatment. Eighty-one percent (109/134) of contacts completed at least six months of therapy and 19% (25/134) had completed less than six months of therapy. Of those who did not complete therapy, 21 had chosen to stop treatment on their own, 20 were lost to follow-up, 14 (5%) were diagnosed with TB disease, 1 died, and 83 (28%) were still on therapy at time of report.

Clinical Distribution

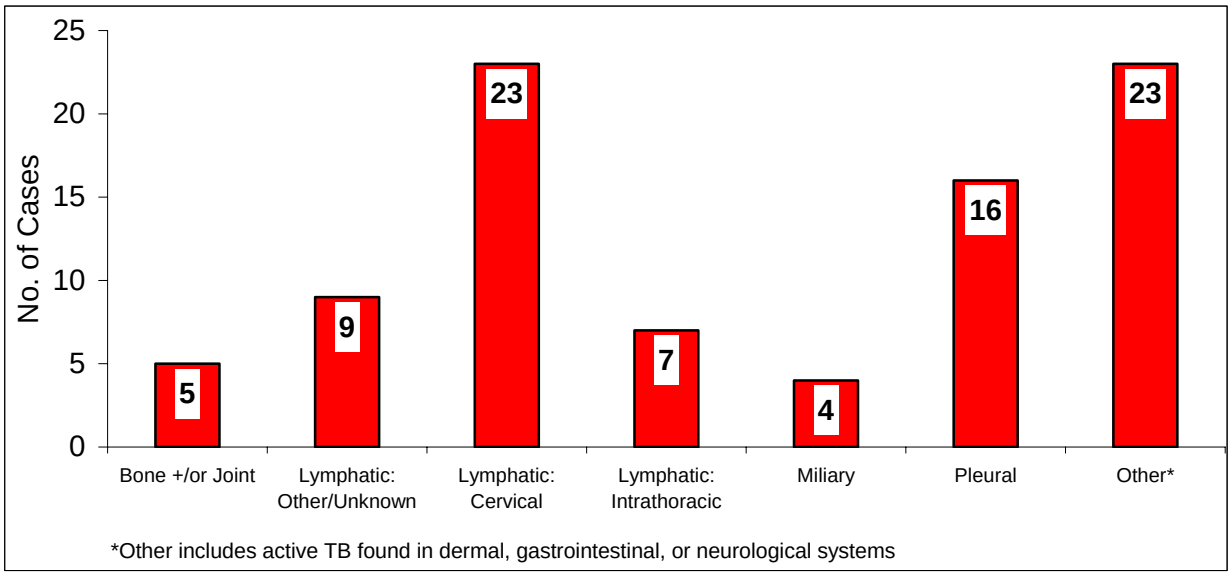
Site of Disease

- In 2005, the majority of cases were pulmonary (Table 7).
- Over half of all TB cases were pulmonary over the last 5 years (Table 7). In 2005, a higher proportion of foreign-born cases were extra-pulmonary as compared with U.S.-born cases (37% vs. 14%, respectively) (Data not shown).
- In 2005, the greatest number of extra-pulmonary TB cases involved the cervical lymphatic system (n=23) (Figure 18).

Table 7
Tuberculosis cases by site of disease, Washington, 2001-2005

	2001 (n=261)		2002 (n=252)		2003 (n=250)		2004 (n=245)		2005 (n=256)	
Site	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Pulmonary	150	(57)	155	(62)	163	(65)	169	(69)	147	(57)
Extra-Pulmonary	84	(32)	76	(30)	64	(26)	51	(21)	75	(29)
Both Pulmonary & Extra	27	(10)	21	(8)	23	(9)	25	(10)	34	(13)

Figure 18
Distribution of extra-pulmonary tuberculosis site of disease, Washington, 2005



Bacteriology

- The proportion of TB cases from which *Mycobacterium tuberculosis* was isolated has decreased over the last 5 years.
- The CDC recommends that diagnostic measures are thorough enough such that ≥85% of all tuberculosis cases are confirmed through isolation of the organism. This increases the specificity of the diagnosis and permits the performance of susceptibility testing, both of which benefit patient care and surveillance information. Washington did not achieve this objective in 2005 with only 81% of cases confirmed through positive cultures (Table 8).
- Of the 181 pulmonary TB cases, 46% (84/181) had a positive sputum smear and 29% (52/181) had a cavitary x-ray (Data not shown). These are crude markers of the proportion of cases that were infectious in 2005.

Table 8
Proportion of tuberculosis cases confirmed by culture, Washington, 2001-2005

Year	Culture + No.	Total Cases No.	Percent of total (%)
2001	228	261	(87)
2002	224	252	(89)
2003	216	250	(86)
2004	203	245	(83)
2005	208	256	(81)

Therapy

CDC Therapy Recommendations

- Of the 250 cases who were alive at the time of their TB diagnosis, 90% (n=226) were prescribed four anti-mycobacterial drugs—isoniazid, rifampin, pyrazinamide, and either ethambutol or streptomycin—as initial therapy for active TB. The American Thoracic Society, Infectious Disease Society of America, and CDC recommend the use of this regimen as initial therapy in communities where INH resistance is found in more than 4% of isolates (see resistance data below).

Directly Observed Therapy[2,3]

- The proportion of cases known to have some DOT administered increased from 2001 to 2004 (73% vs. 98%, respectively). In 2004, DOT usage not only increased 10% from the previous year but also marked the highest proportion of cases administered DOT since TB reporting began in Washington (Table 9).

Table 9
Directly Observed Therapy (DOT) among all TB cases, Washington, 2000- 2004

	Total Cases	Cases with Initial Drug Regimen[a]	Cases with Information on DOT		DOT only or Both DOT & Self-Administered[b]	
Year	No.	No.	No.	(%)	No.	(%)
2000	258	252	252	(100)	209	(83)
2001	261	257	238	(93)	174	(73)
2002	252	250	226	(90)	178	(79)
2003	250	249	237	(95)	211	(89)
2004	245	243	239	(98)	235	(98)

[a] Includes patients alive at diagnosis with initial drug regimen of one or more drugs
[b] Calculated from cases with known information on DOT

Drug Susceptibility Testing & Resistance

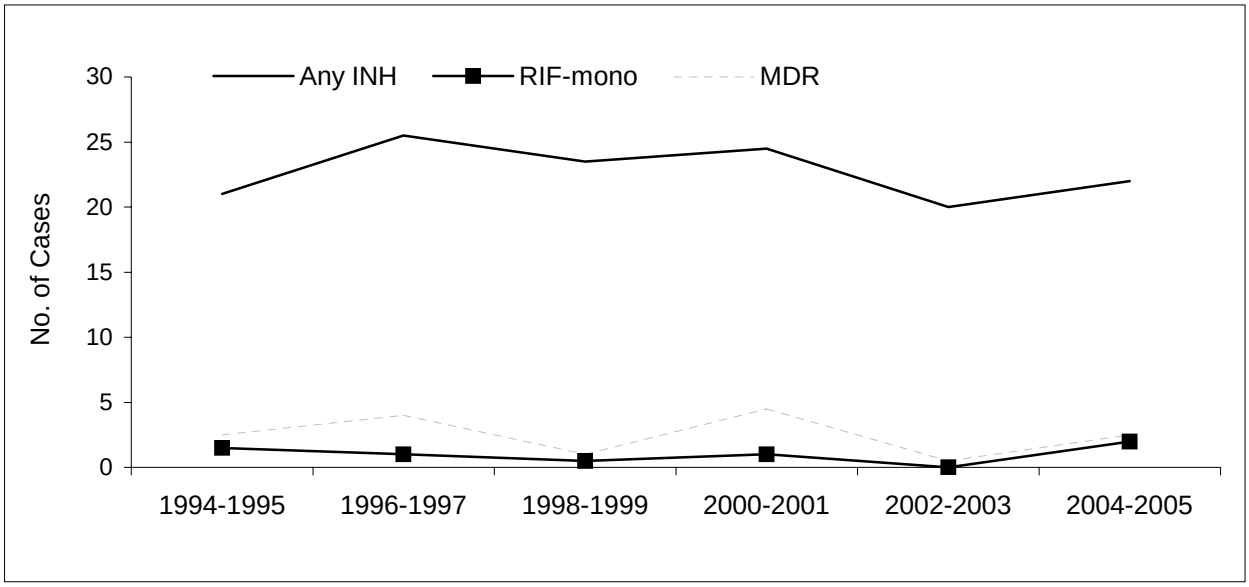
- Of the 208 culture-positive TB cases in 2005, 203 (98%) had drug susceptibility testing done.
- Eighty-two percent (167/203) had no resistance to anti-tuberculosis medicines.
- Thirty-six (18%) had resistance to at least one anti-mycobacterial drug. Twenty-six (13%) were resistant to INH. Drug resistance to INH increased in 2005 (26 cases in 2005 vs. 18 cases in 2004). RIF resistance remains low; there was no rifampin-only resistant cases in 2005 and there was only 1 case in 2004. The number of MDR cases increased by 1 from last year, 3 cases were reported with MDR TB in 2005 (Figure 19).
- Resistance to INH has increased slightly in both Foreign and U.S.-born cases (Figure 20).
- Foreign-born cases comprised 83% of all drug resistant TB cases in 2005, indicating a 5% increase from the previous year. More men than women were drug

[2] Because failure to adhere to treatment increases transmission and increase risk of drug resistance, DOT is becoming a clinical and public health standard of practice for TB control.
[3] With the current TB reporting system, DOT information is not available until the patient completes therapy, therefore a year delay in the report of information will be seen from this report on.

resistant in 2005. Eighty-two percent of all drug-resistant TB cases over the last five years were among foreign-born persons (Table 10).

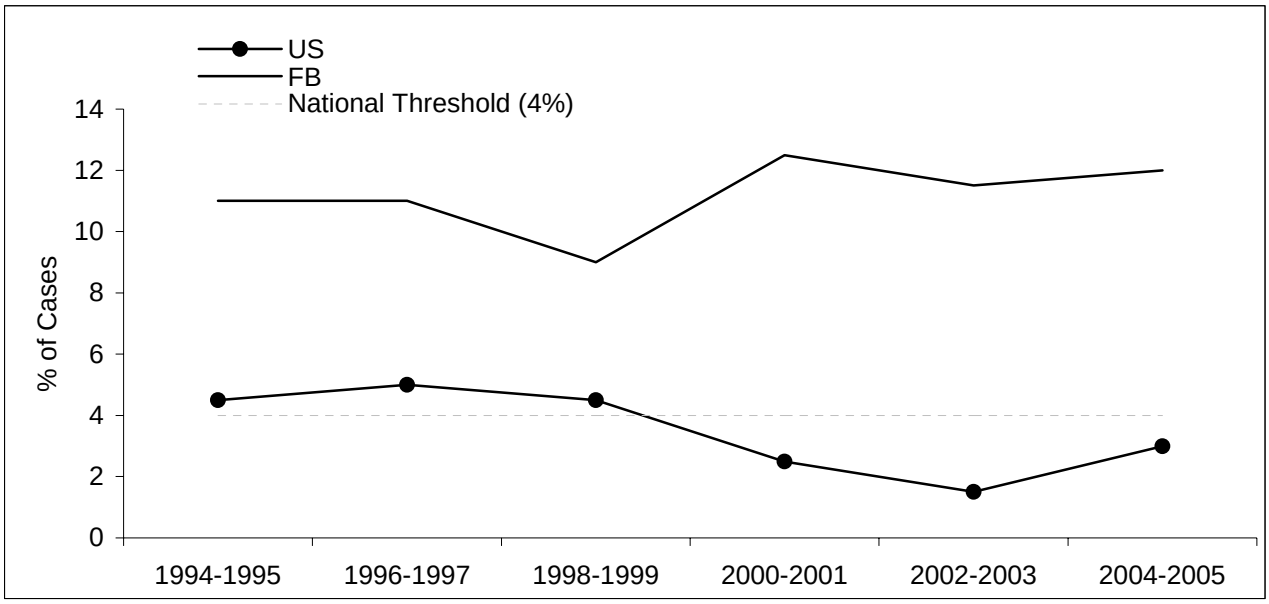
- Drug resistance has been observed in all ages, genders, racial groups, and global regions of origin (including the United States). The majority of the drug resistant cases continue to be among foreign-born persons, cases ages 45 – 64 years, and Asian / Pacific Islanders (Table 10).

Figure 19
Drug resistance patterns for tuberculosis cases, Washington, 1994-2005



Note: 2-Year averages were used to identify possible trends over time.

Figure 20
INH drug resistance among foreign & U.S.-born cases, Washington, 1994-2005



Note: 2-Year averages were used to identify possible trends over time.

Table 10
Characteristics of drug-resistant cases by year, Washington, 2001-2005

	2001 (n=44)		2002 (n=40)		2003 (n=26)		2004 (n=33)		2005 (n=36)	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Age (years)										
0 - 4	1	(2)	1	(3)	0	(-)	1	(3)	0	(-)
5 - 14	2	(5)	0	(-)	3	(12)	0	(-)	1	(3)
15 - 24	5	(11)	6	(15)	2	(8)	5	(15)	6	(17)
25 - 44	21	(48)	14	(35)	10	(38)	12	(36)	9	(25)
45 - 64	9	(20)	6	(15)	8	(31)	10	(30)	13	(36)
65+	6	(14)	13	(33)	3	(12)	5	(15)	7	(19)
Sex										
Male	31	(70)	20	(50)	13	(50)	19	(58)	22	(61)
Female	13	(30)	20	(50)	13	(50)	14	(42)	14	(39)
Race/Ethnicity										
White, alone	7	(16)	5	(13)	4	(15)	10	(30)	12	(33)
Black, alone	8	(18)	4	(10)	2	(8)	6	(18)	7	(19)
Hispanic, all races	3	(7)	8	(20)	4	(15)	4	(12)	0	(-)
American Indian /Alaskan Native	3	(7)	0	(-)	2	(8)	0	(-)	0	(-)
Asian/Pacific Islander	23	(52)	22	(55)	18	(69)	17	(52)	17	(47)
Country of Birth										
U.S.-born	9	(20)	4	(10)	6	(23)	7	(21)	6	(17)
Foreign-born	35	(80)	36	(90)	20	(77)	26	(79)	30	(83)

Tuberculosis and HIV/AIDS

- The number of TB cases among persons with HIV/AIDS increased from 9 cases in 2004 to 15 in 2005.
- Persons co-infected with HIV and TB have traditionally resembled some of the anticipated characteristics of the HIV epidemic, late-20's to early-40's, males and females infected, whites, blacks and Hispanics. The median age for TB-AIDS cases in 2005 was 40 years.

TB-Related Deaths

- In 2005, six cases were dead upon diagnosis and an additional eight cases died after diagnosis. All deaths that were tuberculosis-related and occurred during treatment in 2005 (n=8) had another primary cause of death. From 2001-2005,

only 2% of all cases had TB as the primary cause of death (Table 11). The crude death rate for TB in 2005 was 1.1 per one million people.

Table 11
Deaths among all tuberculosis cases, Washington, 2001-2005

	2001 (n=261)		2002 (n=252)		2003 (n=250)		2004 (n=245)		2005 (n=256)	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Death due to TB	6	(2)	7	(3)	8	(3)	5	(2)	6	(2)
Non-TB Death	4	(2)	6	(2)	6	(2)	4	(2)	4	(2)
Living TB Cases	251	(96)	239	(95)	236	(94)	235	(96)	242	(95)

Note: There were 4 unknown causes of death in the 2005 death data and were therefore excluded from the table.

Washington State Cohort Review

Cohort review is a systematic review of patients with tuberculosis (TB) disease and their contacts. A “cohort” of patients from a specific period of time is reviewed and analyses are based upon individual patient outcomes. Cohort review is a tool used to increase staff knowledge, hold staff accountable to the management of their TB cases, and identify program strengths and weaknesses. The review allows staff to ask expert clinicians and managers about patient care. Patients are less likely to “fall through the cracks” and receive inadequate care. The Washington (WA) State TB Program implemented cohort review in May of 2003. Washington State is considered a medium incidence state (4.0 cases per 100,000 population in 2005).

Cohort review sessions are conducted on cases counted in a 3 month period beginning 9 months earlier. In addition to case reviews, analyses of cases and their contacts are provided. An annual analysis of the outcome and timeliness measures was conducted for 2003-2004 cases and their contacts. The purpose of the analysis is to measure the impact of cohort review on the management of TB cases in WA State.

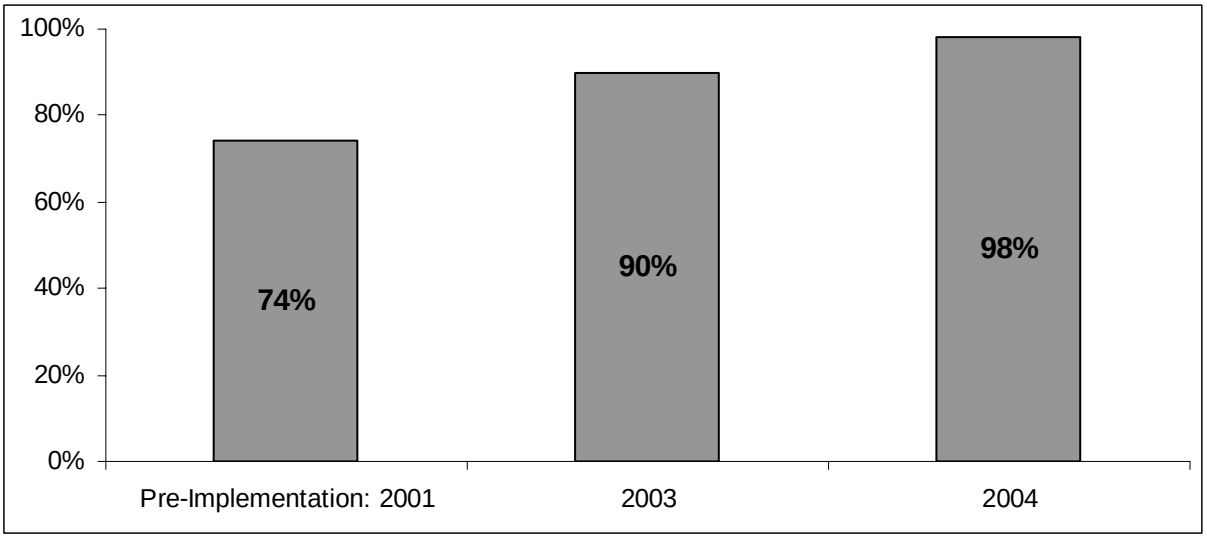
A comparison of data prior to the implementation of cohort review (2001) and the last 2 years of complete data (2003 and 2004) show that the closer scrutiny of cases and contacts and an increased understanding of TB morbidity has improved patient outcomes in Washington State.

Case Outcome Measures

Directly Observed Therapy (DOT)

Selected outcome measures are reviewed every quarter at a cohort review session. The percentage of cases on directly observed therapy (DOT) comprises those cases closed out (i.e.; completed treatment, moved, lost, or died) and cases that were either all on DOT or were both DOT and self-administered TB medication. Washington State has dramatically improved the usage of DOT on all TB patients. Figure 21 shows pre-implementation data (2001) on the use of DOT was 74%. In 2003, the proportion increased to 90% and in 2004, the proportion almost reached 100%, at 98%.

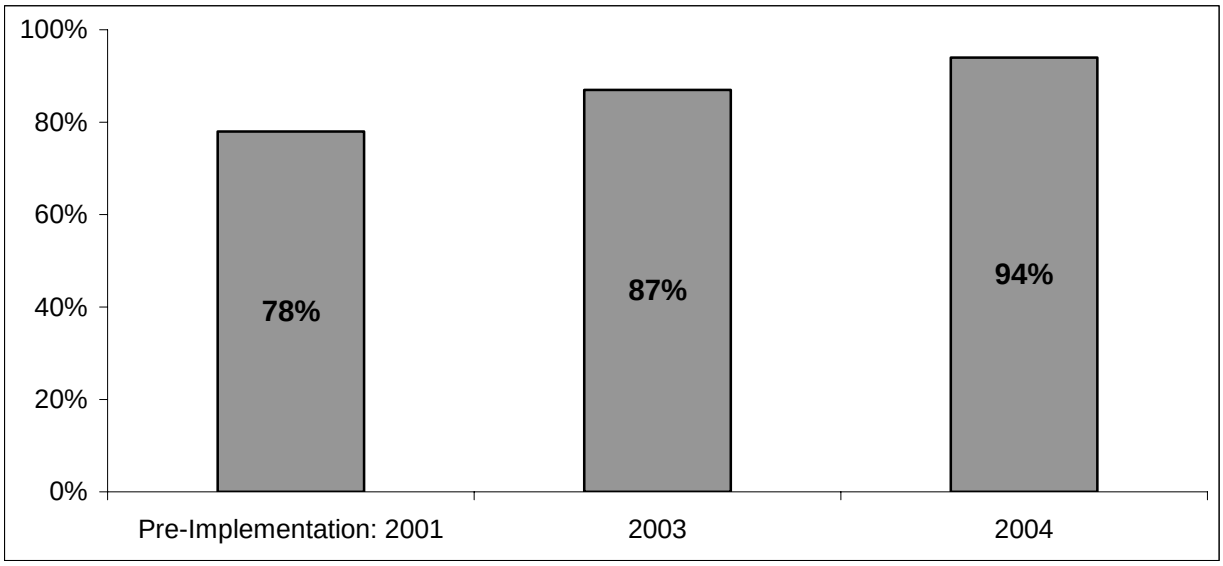
Figure 21
Percentage of cases on directly observed therapy (DOT), Washington



HIV Screening

As part of the cohort review sessions, Washington added a measure to track whether or not case managers, nurses, or providers were offering HIV tests as part of their screening of patients for tuberculosis because HIV disease has effects on the treatment and management of patients with TB. In 2001, the proportion of cases offered an HIV test was 78%. In 2003, this increased to 87% and in 2004, this proportion increased further to 94% (Figure 22).

Figure 22
Percentage of cases offered an HIV test at the time of TB screening, Washington

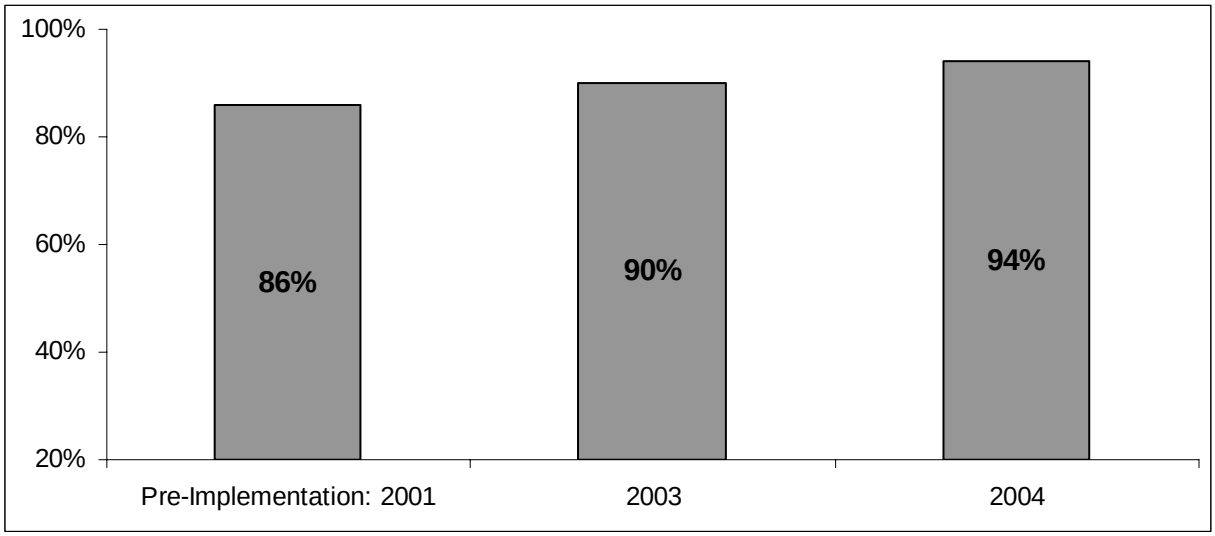


Infectious Cases (Sputum Smear Positive)

Completion of TB Medication

The completion of TB medication among infectious cases improved since the implementation of cohort review. Figure 23 shows that 86% of cases completed treatment pre-implementation (2001) and 90% in 2003. In 2004, the proportion increased again (94%).

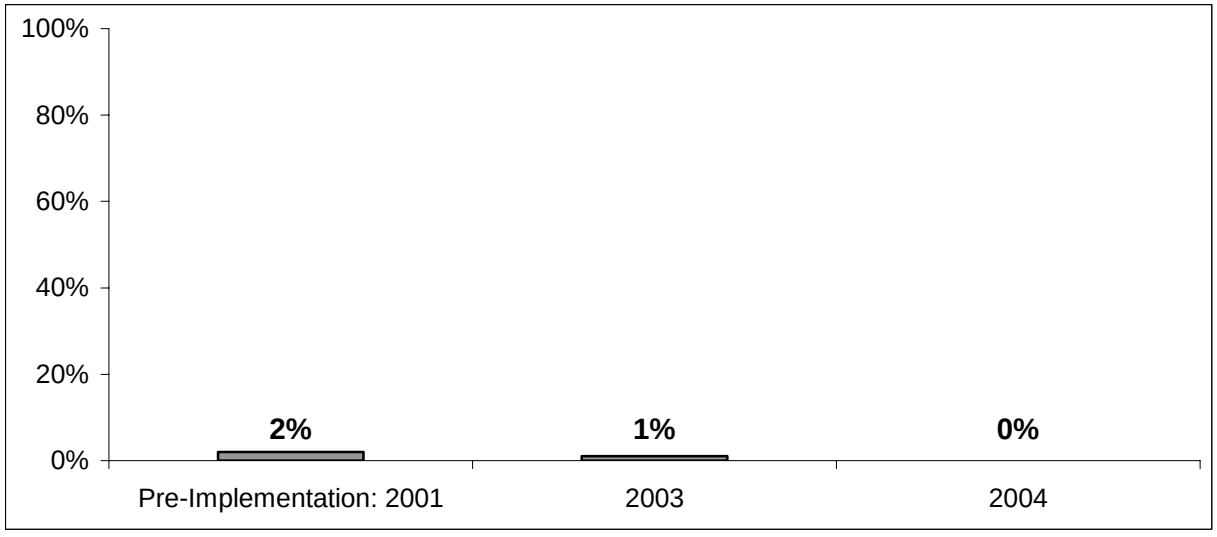
Figure 23
Percentage of infectious cases completing TB medication, Washington



Lost to Follow-Up

Washington already had few infectious cases that were lost during their TB treatment. In 2004, however, none of the infectious cases were lost to follow-up (Figure 24).

Figure 24
Percentage of infectious cases lost to follow-up after starting TB medication, Washington



Case Timeliness Measures

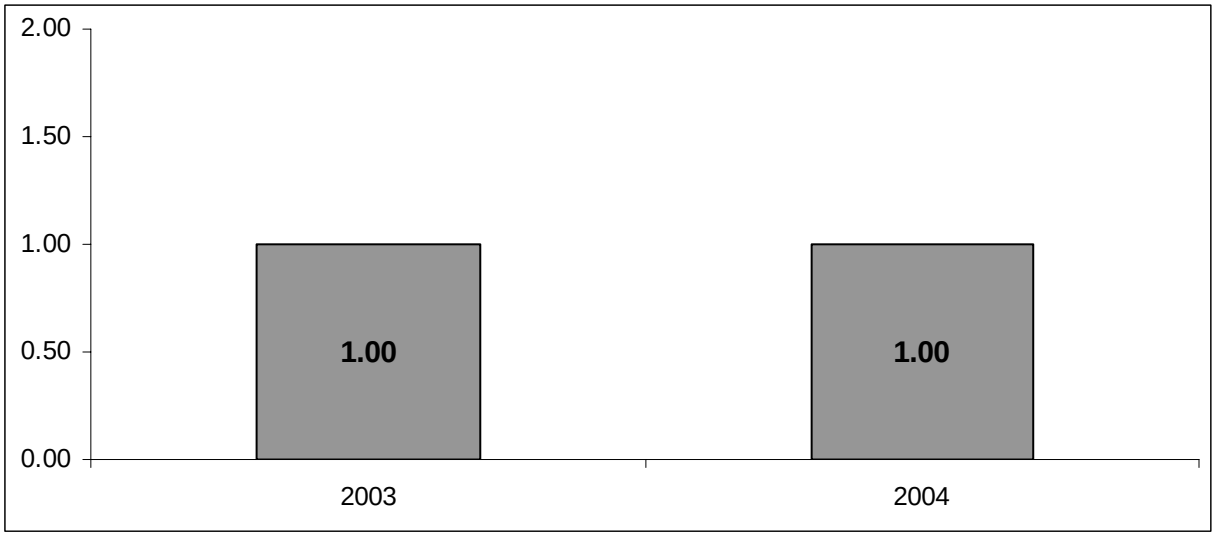
Timeliness measures refer to outcome measures that were created by DOH TB Program in order to review the timeliness of reporting specific case information between labs, health care providers, local health jurisdictions, and DOH. At each cohort review session, timeliness measures are evaluated using the median (middle) number of days between 2 dates. Median is used as the analysis tool for reviewing measures of dispersion because outliers or dates that are abnormal will not skew the results. This gives a better indication of the true number of days between 2 dates.

Because timeliness measures were created by DOH TB Program, analysis of pre-implementation data from 2001 is not included in the following section. A comparison of data from 2003 and 2004 are reviewed.

Timeliness: Lab Sputum Collection

Figure 25 shows that the timeliness of shipping sputum for testing at a lab did not change from 2003 to 2004. It took 1 day from collection to receipt at the lab.

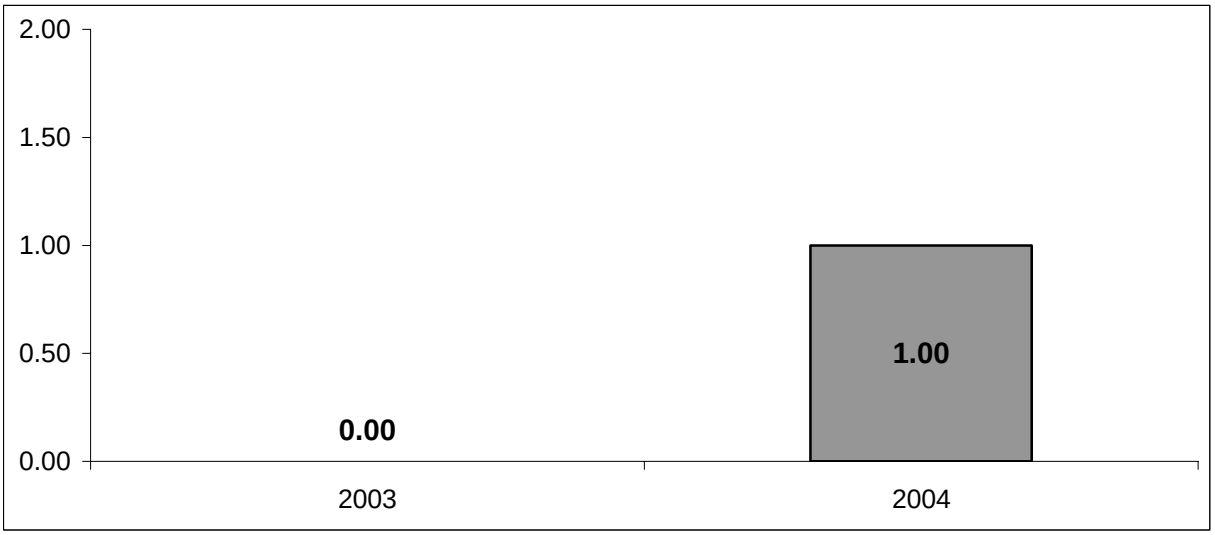
Figure 25
Median number of days between sputum collection and when it was received at a lab, Washington



Timeliness: Meds Starting

Figure 26 shows that in 2003, medication was started the same day that a provider obtained a smear positive result on a case. In 2004 however, one day elapsed between receiving a smear positive result and starting TB medication.

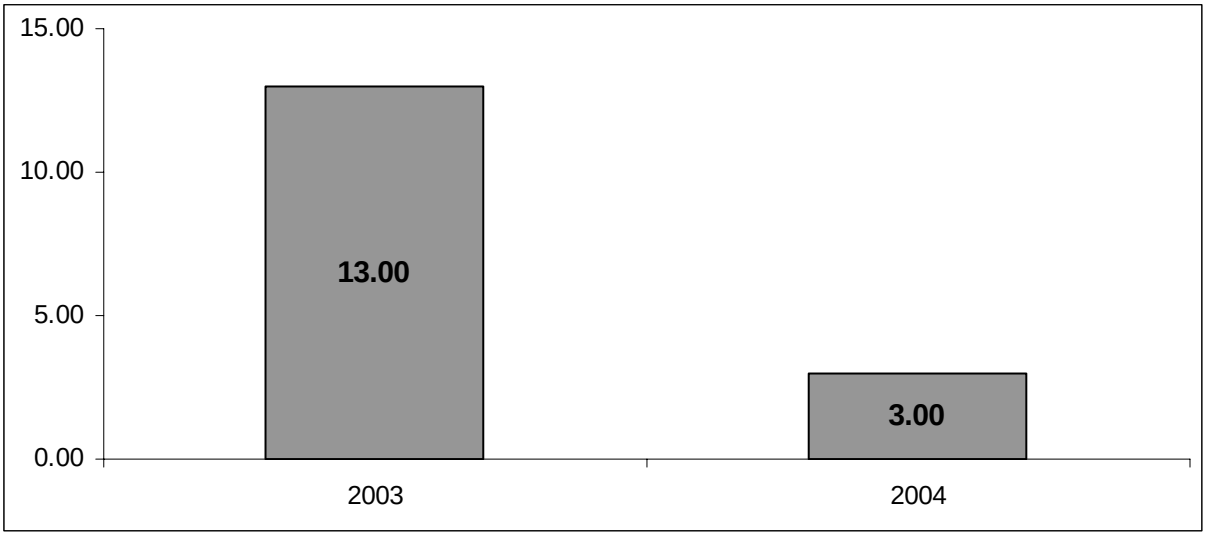
Figure 26
Median number of days between sputum smear + result and when medication started, Washington



Timeliness Reporting: LHJ- DOH

Figure 27 shows the median number of days between the date the case reported a smear + result and when the local health jurisdiction (LHJ) reported the case to the state department of health (DOH). In 2003, it took 13 days to report the case and in 2004, it only took 3 days.

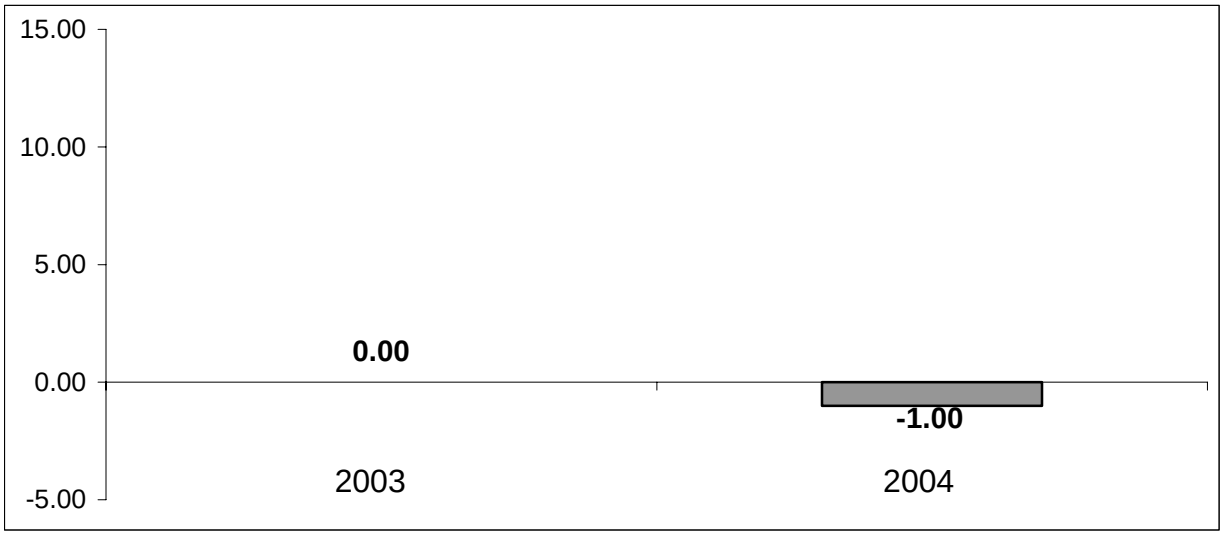
Figure 27
Median number of days between the smear + date and when the LHJ reported the case to DOH, Washington



Timeliness Reporting: HCP-LHJ

Figure 28 shows the number of days between the smear + result and when the health care provider (HCP) reported the case to LHJ. In 2003, the HCP reported the smear positive result on the same day they received the result. In 2004, the HCP reported the case a day before they received the smear positive result.

Figure 28
Median number of days between the smear + date and when the HCP reported the case to DOH, Washington



Timeliness Reporting: Lab-LHJ

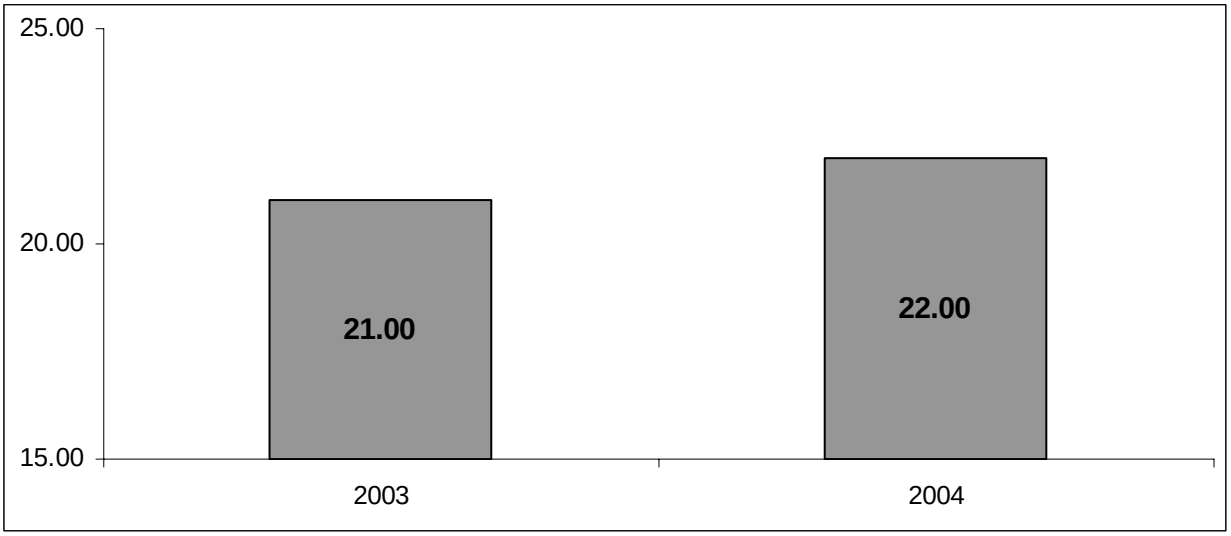
Laboratory reporting of TB disease information has consistently been efficient. Both in 2003 and 2004, the labs were reporting smear positive results to the LHJs within the same day of testing the specimens (Figure 29).

Figure 29
Median number of days between the smear + date and when a lab reported that information to the LHJ, Washington

Timeliness Reporting: Susceptibility

Figure 30 shows the time between the culture + date and when the susceptibility information was reported back to the LHJ. In 2003, it took an average of 21 days to report the susceptibility results and in 2004, this increased by 1 day (22).

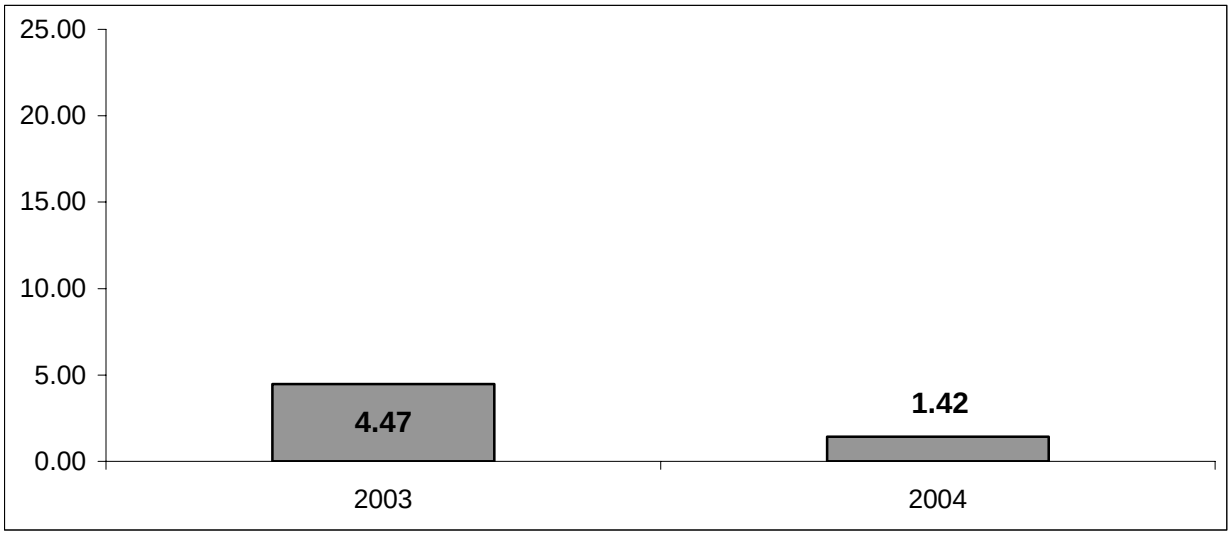
Figure 30
Median number of days between culture + date and when the susceptibility results were reported, Washington



Contact Timeliness Measures

Figure 31 shows the number of days between the smear positive result and when contacts were identified for the smear + case. In 2003, it took more than 4 days to identify contacts and in 2004 this decreased by over half (1.4 days).

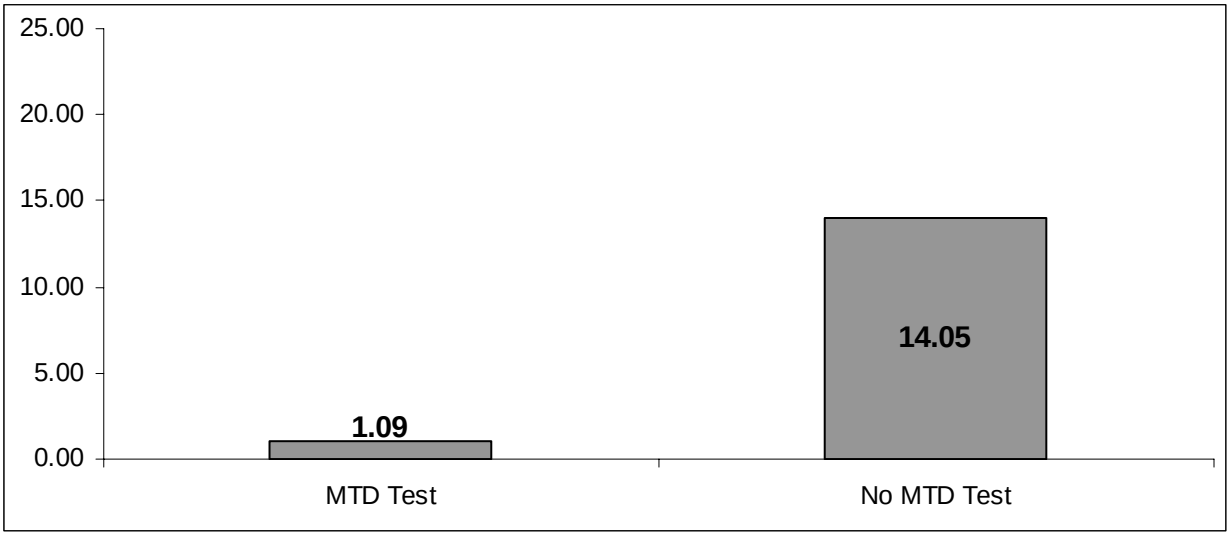
Figure 31
Median number of days between the smear + date and when contacts were identified for that case, Washington



Timeliness Measures: MTD Testing

In 2004, Washington added MTD as a timeliness measure to see if MTD testing sped up the management of a case by returning results on the culture in a faster time than conventional tests. Figure 32 compares culture positive cases that had an MTD test versus those who did not. The average number of days between when sputum was collected to when medication was started was compared to see if MTD testing started a case on treatment earlier than conventional testing. By administering an MTD test, a culture positive case started treatment after 1 day of their sputum being collected versus those who had a conventional test and had to wait 2 weeks to start treatment.

Figure 32
Average number of days between sputum collection to when medication was started by MTD testing, Washington, 2004



CONCLUSION

The Washington State tuberculosis crude incidence rate increased slightly (2%) to 4.0 per 100,000 in 2005, marking the end in the decline of the state rate since 1998. TB disproportionately affects persons ages 65 and over, who had higher case rates than any other age group (7.7 per 100,000). Over the last five years, persons classified as white maintained an incidence rate lower than the state rate, while persons among minority populations continue to be overrepresented in the TB data and have case rates higher than the state rate. Trends in the incidence rates of TB according to racial and ethnic characteristics show increases in case rates among blacks and American Indian/Alaskan Natives, while case rates among Asian/ Pacific Islanders have declined. Ten-year trends among foreign-born populations indicate proportional increases in both case numbers and resistance, specifically to INH. The proportion of cases who were on directly observed therapy (DOT) either all or partially increased substantially over the past 5 years with 98% on DOT in 2004 (the latest year of complete data). Contacts remain a burden to the elimination of TB in Washington. As case numbers and rates decline, a greater focus on contacts and their completion of therapy is imperative. In 2005, 73% of infectious cases (sputum smear positive) identified at least 1 contact indicating that 23 possibly infectious cases did not identify any contacts. In addition, only 17% of the contacts that were identified to infectious cases were evaluated.

The proportion of tuberculosis cases was low among persons living in residential or correctional facilities (4%) and among persons with HIV (6%). The proportion of cases that were unemployed has increased over the past few years with almost half (48%) of all cases reported as unemployed in 2005.

Drug resistance increased slightly in Washington State. There were 36 cases that were resistant to at least 1 TB medicine in 2005, a slight increase since 2004. In addition, there were 26 INH-resistant cases and three cases of MDR-TB reported in 2005.

Priorities for Tuberculosis Control and Prevention

1. **Case-Finding**

Identify all active cases of TB and ensure completion of an adequate course of curative treatment.

2. **Close Contacts**

All close contacts of pulmonary cases should be identified, screened, placed on appropriate preventive therapy, if clinically indicated, and followed for therapy completion. National data and the CDC indicate that persons who are closely associated with persons who have active TB have a greater risk in not only becoming infected but also in developing disease within the first two years after infection.

3. Targeted Screening

- *Foreign-born* - The proportion of TB cases associated with persons born outside the United States continues to grow. In 2005, 67% of all cases were foreign-born. A focus on closing the gap between US-born and foreign-born populations is critical for future TB control efforts.

- *Persons with HIV/AIDS* - Compared to national data, Washington State has been fortunate not to have a significant amount of TB associated with AIDS and data from 1994-2005 suggests that although co-morbidity may be slightly increasing in recent years, this increase still reflects low case numbers. All HIV-infected persons should be evaluated for eligibility for antiretroviral therapy and should be screened and, if warranted, treated for latent TB infection.

- *Persons with other medical conditions* – Persons with other medical conditions (e.g., diabetes, organ transplant, other immunosuppression, end-stage renal disease) that predispose to TB acquisition or reactivation.

- *Marginalized Populations* - 16% of new cases in 2005 reported homelessness in the last 12 months. Two percent of TB cases indicated IV drug use in the past year, although this may be underreported. Targeted screening in theses groups could be effective if follow-up and adherence to therapy for latent infection can be assured.

- *Minority populations* – The TB incidence rates for blacks, Asians, American Indians and Hispanics are higher than that of whites and may be a reasonable surrogate marker for identifying a higher prevalence of infection, particularly when associated with a higher prevalence of risk factors in those groups. Caution is warranted for targeting populations based solely upon race and ethnicity.

Tuberculosis continues to deserve special attention in Washington State, despite recent declines. Excess cases reported in King County and increases in the number and proportion of cases attributable to persons born outside the United States, especially among recent arrivals, highlight the complexities and challenges of TB control. Cases in Washington State are concentrated in the urban centers of King, Pierce, Snohomish, Spokane, Yakima, and Clark counties, calling for a concentration of disease control resources in these areas. However, changes in demographics, populations, and immigration destinations may influence the incidence of TB in other counties of the state. Continued success in lowering TB rates calls for adequate resources at all levels to increase DOT coverage and completion of therapy for all cases of active disease, as well as to identify, screen, and treat recent foreign-born arrivals and other populations known to have a large burden of inactive TB or latent TB infection.

APPENDIX 1

OVERVIEW OF TB AMONG SEATTLE'S HOMELESS POPULATION, 2002 - 2004

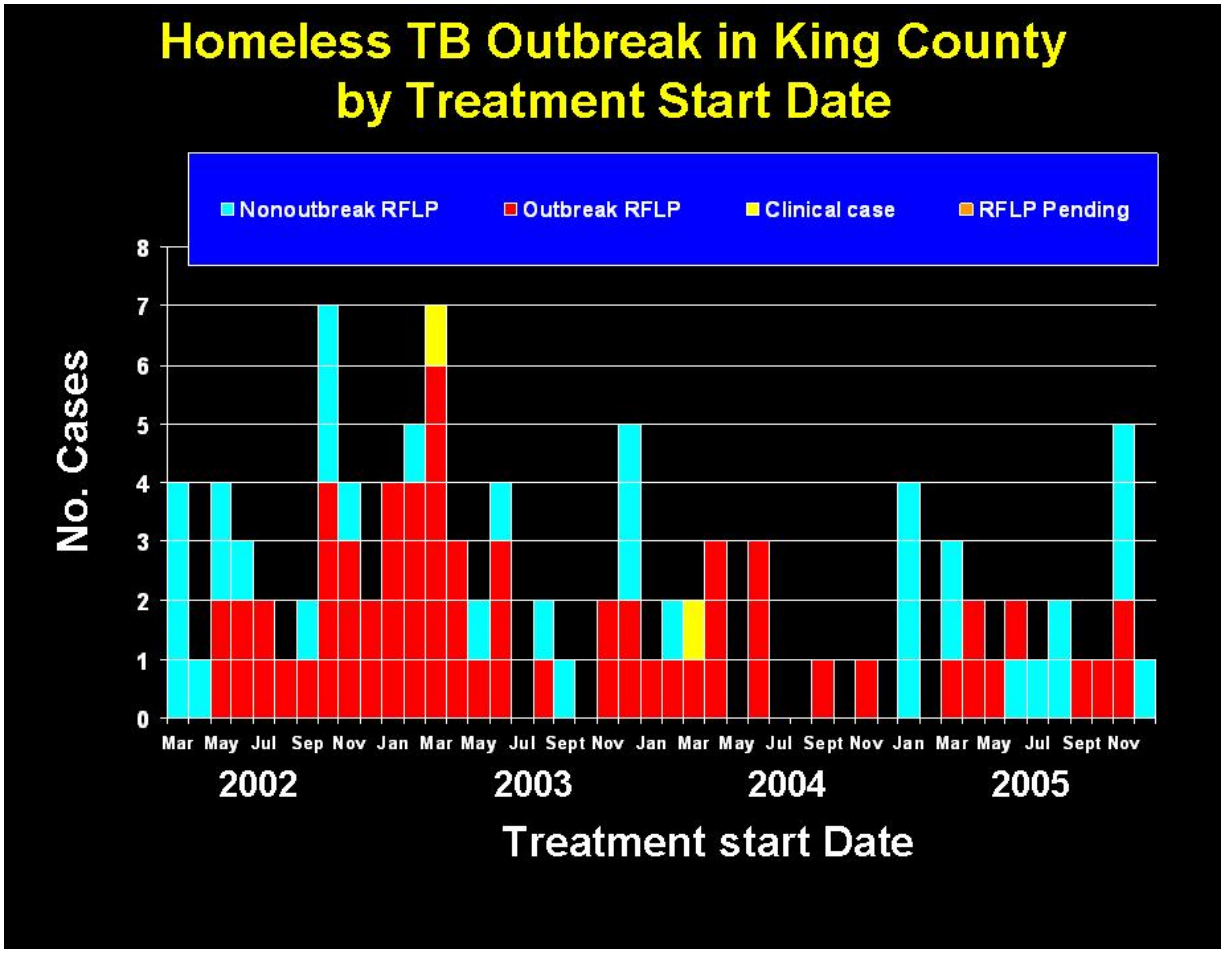
Contributed by: King County TB Program, May 2006

There were 23 homeless cases diagnosed with TB in 2005, comprising 18% of all TB cases in King County, comparable to the year before. Homelessness was defined as people who lacked a fixed, regular, and adequate night-time residence or whose primary night-time residence was a supervised shelter designed to provide temporary living accommodations.

Of the 23 homeless cases, 13 were born in US, and this represents 41% of US-born TB cases in King County. Six Hispanic homeless cases were seen in 2005, which is an increase from the past several years (range from 1-3 between 2002 and 2004). In contrast, the number of American Indian cases, the predominant case group during the 2002-2003 outbreak, continued to decrease (17 in 2003 to 2 in 2005).

About 15% of TB cases in Washington State are homeless. Nationwide, homeless cases currently represent 6% of all TB cases, although rates fluctuate widely by state.

Figure 33
Homeless TB cases in king County



In 2002, a TB outbreak among the homeless was detected. One strain (the outbreak strain) caused 17 cases in 2002. In 2003, the outbreak strain was responsible for 27 cases (77%) of the homeless TB cases. Over the past 2 years, due to intensive effort to control this outbreak, the number of TB cases matching the outbreak strain dropped considerably (11 cases [48% of homeless] in 2004 and 9 cases [39%] in 2005).

We consider the outbreak to be currently contained; however, it is clear that reactivation of the outbreak strain is still taking place, as indicated by genotyping results. This illustrates the difficulty of ensuring treatment of latent TB infection among homeless individuals who were exposed to infectious TB patients who were homeless in 2002 and 2003.

Table 12
Who are the Homeless Cases in King County?

	2002	2003	2004	2004**	2005
	(n=30)	*(n=35)*	*(n=15)*	*(n=23)*	*(n=23)*
	N (%)	N (%)	N (%)	N (%)	N (%)
Gender					
Male	26 (87)	27 (77)	12 (80)	20 (87)	21 (91)
Female	4 (13)	8 (23)	3 (20)	3 (13)	2 (9)
Age Group					
15-30	1 (3)	1 (3)	0 (0)	8 (35)	1 (4)
31-40	8 (27)	2 (6)	2 (13)	2 (9)	3 (13)
41-50	10 (33)	16 (46)	4 (26)	4 (17)	10 (43)
51-60	9 (30)	13 (37)	5 (33)	5 (22)	6 (26)
61-70	2 (7)	1 (3)	3 (20)	3 (13)	2 (9)
71-80	0 (0)	2 (6)	1 (7)	1 (4)	1 (4)
Race/Ethnicity					
White, non-Hispanic	3 (10)	7 (20)	3 (20)	3 (13)	5 (22)
Black, non-Hispanic	12 (40)	8 (23)	3 (20)	11 (48)	7 (30)
Hispanic	3 (10)	3 (9)	1 (7)	1 (4)	6 (26)
Asian/Pacific Islander	1 (3)	0 (0)	0 (0)	0 (0)	3 (13)
American Indian/Alaska Native	11 (37)	17 (49)	8 (53)	8 (35)	2 (9)
US-born?					
Yes	25 (83)	33 (94)	13 (87)	13 (57)	13 (57)
No	5 (17)	2 (6)	2 (13)	10 (43)	10 (43)
HIV Result					
Positive	9 (30)	1 (3)	0 (0)	0 (0)	1 (4)
Unknown	1 (3)	0 (0)	2 (13)*	3 (13)	4 (17)
Genotyping					
RFLP Match	17 (57)	26 (74)	11 (73)	11 (48)	9 (39)
American Indian RFLP match	9	15	7	7	2
Other race RFLP match	8	10	4	4	7
Non-outbreak RFLP	13 (43)	8 (23)	2 (13)	10 (43)	14 (61)
Pending	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Clinical Case	0 (0)	1 (3)	2 (13)	2 (9)	0 (0)
No RFLP done	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

*Some patients refused HIV test

**Includes East African Outbreak patients who were homeless

APPENDIX 2

TB OUTBREAK AMONG YOUNG EAST AFRICANS IN SEATTLE, 2004

Contributed by: King County TB Program, May 2006

We had an outbreak of TB among mostly young men of East African origin in 2004. Eleven cases were genotypically linked with a matching strain type, and one clinical case was epidemiologically linked to the outbreak. This group was generally involved in illicit drug selling and use, and had a history of incarceration and hospitalizations due to gun or knife injuries. However, no further cases with this strain were diagnosed in 2005.

APPENDIX 3

BACKGROUND
Goals of Epidemiologic Profile

The goals of the Tuberculosis Epidemiologic Profile are:

1. **Describe in detail the distribution and determinants of TB in Washington;**
2. **Highlight disparities in disease incidence among sub-populations;**
3. **Provide temporal trends of tuberculosis;**
4. **Provide guidance to TB prevention, control, and policy development in Washington State.**

Data Sources

The following data sources have provided identification and management information of TB suspects and cases for the Tuberculosis Epidemiologic Profile:

- TB case reports from local health jurisdictions;
- State-sponsored nursing staff case management updates; and
- Public Health Laboratory specimen testing reports.

Terminology and definitions used in this report are explained in Appendix 4. A brief summary of the TB surveillance system and data quality and limitations can be found in Appendix 5. Readers are advised to review these appendices carefully to fully understand the complexities of the surveillance system and its impact on data quality.

Guidelines to Prevent Misuse of Data[4]

Ready access to data by persons unfamiliar with the sources or unacquainted with epidemiology and statistics sometimes leads to misinterpretation or misrepresentation of information. This could result in inappropriate decision-making and misdirection of resources. The following guidelines may help prevent data misuse and should always be considered when reviewing data from any source:

1. Understand what you are looking at. What do the data cover? Do the data represent TB infections or TB cases? Do the numbers reflect new (incident) cases or cumulative numbers of cases? Are trends presented appropriately, using the same criteria for the numerator and denominator over the period of investigation?

2. Know the limitations of the data source. How is the information collected? How accurate and complete are the data? Do the data represent the general population or just a very select subgroup?

[4] Adapted from Washington State HIV/AIDS Epidemiologic Profile, page 8.

3. Do not over interpret small changes. Small increases and decreases in numbers can look large if the baseline numbers are small to begin with. For example, if two cases of TB are counted in a particular county in one year and three cases are counted the next year this is an increase of 50%. This may sound significant, but a change of one case is not. Caution is warranted.

4. Look for consistencies with other sources of information. Results from an investigation are more believable if they are supported by similar findings from other known studies. This does not mean that new findings should be ignored, but they may deserve a little more attention in establishing their conclusions.

In summary, data should never be taken at surface value. They should be closely scrutinized, analyzed, and placed into context before any decisions are made.

APPENDIX 4

Terminology and Definitions

The intricacies of tuberculosis case identification and management require the reader to be familiar with some specific epidemiologic terms and surveillance criteria.

- Tuberculosis Suspect - Any person who reports clinical symptoms associated with TB, e.g. productive, prolonged cough, chest pain, hemoptysis, fever, chills, loss of appetite, or weight loss, and is evaluated by a medical practitioner for tuberculosis, which may include diagnostic X-rays and bacteriology collection, is considered a suspect. All practicing physicians are required by Washington State law to report all suspects of TB to their local health authorities immediately (WAC 246 -101-101); in turn, local health authorities are required to report these suspects within seven days to the state TB Control Program (WAC 246 -101- 510).

- Tuberculosis Case - The Centers for Disease Control and Prevention (CDC) has outlined two sets of case-defining criteria, laboratory confirmed and clinically confirmed (Table 12).[5] A person suspected of having TB must meet one of the two case definitions to be considered an active case. This report focuses on active tuberculosis cases.

Table 13
Tuberculosis case definition criteria

Laboratory Case Definition (*must meet ANY of the following criteria*)	**Clinical Case Definition** (*must meet ALL of the following criteria*)
• Isolation of *Mycobacterium tuberculosis* using culture techniques from a clinical specimen; OR	• Positive tuberculin skin test (negative test is allowed for those patients with proven anergy or an AIDS diagnosis); AND
• Demonstration of *Mycobacterium tuberculosis* from a clinical specimen by DNA probe or mycolic acid pattern on high-pressure liquid chromatography; OR	• Other signs and symptoms compatible with TB, such as an abnormal or unstable chest x-ray or clinical evidence of current disease; AND
• Demonstration of acid-fast bacilli in clinical specimen when a culture has not been or cannot be obtained in a patient with clinical symptoms of tuberculosis.	• X-ray improvement on chemotherapy; AND
	• Treatment with two or more anti-tuberculosis medications; AND
	• Completed diagnostic evaluation.

[5] Core Curriculum on Tuberculosis, Third Edition. Centers for Disease Control and Prevention. Atlanta, Georgia, 1994.

A relatively small number of TB cases dispersed among a large number of counties in Washington limits the ability to perform county-specific analyses. A minor disease outbreak, a clustering of cases, county demographics, and the effect of prison populations in several counties impact the measurement of this disease at the county level. The number of reported and counted cases within each county may not reflect all efforts of TB case management and control occurring within county jurisdictions. Cases that are reportable-but-not-countable may be under the supervision of local health departments and receiving TB treatment, directly observed therapy, and case management but not included in the official counts for TB morbidity. When assessing true "burden of disease" on local health department infrastructure and resources, it may be necessary to assess the impact of cases that are reportable-but-not-countable in addition to the cases included in state morbidity totals.

- Active vs. Inactive - A distinction is made between active cases of TB and inactive cases of TB. Active cases have positive cultures for *Mycobacterium tuberculosis* or a positive tuberculin skin test and clinical or radiographic evidence of current disease. Active cases are often infectious. Inactive cases have a history of TB disease or abnormal but stable X-rays, positive tuberculin skin tests, negative bacteriologic evaluations, and no clinical evidence of current disease. Inactive cases are never infectious.

- Infected vs. Diseased - Persons who have positive tuberculin skin tests but no clinical or radiographic evidence of TB are considered infected. These persons are non-infectious and cannot transmit the tubercle bacillus. Diseased persons have met one of the case definition criteria. "Diseased," "active," and "TB case" are terms often used together and interchangeably to identify the population of persons known to have current disease.

- Counted Case vs. Reportable-But-Not-Countable - To avoid duplication, a case of TB is only counted by Washington State if another county, state, or country has not already counted the current episode of TB disease. Therefore, all new cases of TB for Washington were first identified as active TB in this state. Frequently, the state TB Program is notified of persons entering our state with TB for whom therapy and case management is required to be confirmed by local health jurisdictions. In this situation, these persons are classified as "Reportable but Not Countable," meaning the case must be reported to the CDC but was already counted by another locality. There are additional situations that make a person "Reportable but Not Countable" for TB.

  A case is "Reportable but Not Countable" if:
  (1) the case enters the United States with active TB and on treatment; OR
  (2) the case moved to Washington from another state or country after identification of tuberculosis, treatment started, and case reported in the originating state or country; OR

(3) the case has been off therapy from a previous episode of TB disease for less than one year.

- Incidence - The number of new cases of disease, usually within a given time period. For example, in 2005, there were 256 new cases of TB; therefore, the incidence of TB was 256.

- Crude Incidence Rate[6] - The number of new cases per unit population for a given time period, usually a year. This calculation accounts for the size of the population. The following equation describes the crude incidence rate:

$$\text{Rate} = \frac{\text{Number of new cases in a population}}{\text{Number of people in the population}}$$

  Rates are usually expressed in terms of cases per 100,000 population. Rate calculations allow for comparisons between populations by adjusting for the different sizes of the populations. Rates are not calculated for fewer than five cases in a population, including zero cases, because the calculated rate is unstable and exhibits wide confidence intervals.

  Rates calculated from surveillance data are only as reliable as the surveillance system itself; if all cases of the disease measured are reported within the surveillance system, then the rate calculated is most likely the true rate in the population. However, if under-reporting of disease is suspected and cases are missed by the surveillance system, then the rate calculated using surveillance data may only estimate the true rate in the population.

- Denominator Data – Data from 2000 - 2005: Office of Financial Management, Washington State: Revised February 2005. Data from 1994 - 1999: Census of Population and Housing, 1990: MARS files of Washington State, U.S. Bureau of the Census 1990-1999. Analysis Software: SAS v9.1.2, SAS Institute, 2006.

- Confidence Interval - The confidence interval (CI) evaluates the influence of chance or random variability on the statistical estimate or rate (Selvin, 1996). Surveillance data, even based on complete counts, may be affected by chance. If variation in the occurrence of the disease is random and not affected by inconsistency in diagnosing or reporting, then confidence intervals may be calculated to facilitate comparisons over time or between geographic locations (e.g. counties). In this situation, calculated confidence intervals should be based on a Poisson probability distribution. In general, if confidence intervals for two separate rates overlap, there is no statistically significant difference between the two rates.

  Narrow confidence intervals for rates indicate with greater certainty that the calculated rate is a reliable approximation of the true rate, while wide confidence

[6] Adapted from the Washington State HIV/AIDS Epidemiologic Profile. Department of Health, Office of Infectious Disease and Reproductive Health, Assessment Unit, 1996.

intervals signal greater variability and less certainty that the calculated rate is a good estimation of the true rate.

- Race - All suspects or cases of TB are categorized according to race. Race can be self-reported, extracted from the medical record, or visually assessed by clinical or administrative staff. One of four races must be indicated on the TB case report: White, Black, Asian/Pacific Islander, or American Indian/Alaska Native. Race is reported and counted separately from ethnicity. In 2003, race classifications changed to add a multi-race option.

- Ethnicity - All suspects or cases of TB need to have Hispanic or non-Hispanic ethnicity indicated on the TB case report. Ethnicity can be self-reported, extracted from the medical record, or visually assessed by clinical or administrative staff. Ethnicity is reported and counted separately from race.

- Foreign-born - The term foreign-born is applied to any person born outside the United States, American Samoa, Federated States of Micronesia, Guam, Marshall Islands, Midway Island, Northern Mariana Islands, Puerto Rico, Republic of Palau, U.S. Minor Outlying Islands, U.S. Miscellaneous Pacific Islands, and U.S. Virgin Islands. The month and year that these persons entered the U.S. is recorded on the TB case report. It is important to note that even though these persons are born outside the United States, their duration of residence in the U.S. may be inaccurate or unknown.

- Multi-drug Resistant TB (MDR-TB) - Any case of TB that is found to be resistant to both isoniazid and rifampin, the two primary first-line antituberculosis medications, is defined as having MDR-TB.

APPENDIX 5

Tuberculosis Surveillance System

TB surveillance in Washington State incorporates both active case finding and passive case reporting. Through active case finding, the TB Control Program at the Department of Health is able to recognize potential suspects of TB in the early stages of the disease, expediting the patient's treatment and reducing the patient's infectious period. This is accomplished mainly by a direct computer link to the Washington State Public Health Laboratory whereby results of specimen testing for tuberculosis are received at DOH TB at the same time they are recorded at the laboratory.

The passive aspect of the TB surveillance system relies on providers of care to report potential TB suspects to authorities at their local health departments. The Washington Administrative Code requires all practicing physicians to report suspects of TB to the local health authorities immediately – updated and effective 12/23/2000 (WAC 246-101-101). Timely reporting of suspects and cases by practitioners allows local health authorities to monitor disease appropriately, perform contact tracing, and provide diagnostic expertise to those who may unwittingly be infected. Subsequently, county health departments are required to report these suspects within seven working days by submission of a case report to the state DOH TB (WAC 246-101-510). The case report is the primary data collection tool for tuberculosis. The data elements reported upon initial case notification include but are not limited to demographics, history of TB, bacteriology, site and therapy for current episode of TB, and risk factors. Additional data elements are continuously reported to the DOH TB throughout the management of the case at the county level. These are changes in address, bacteriology results, chest x-ray (CXR) results, and therapy regimens. During the management of the case, local health authorities are also responsible for directing and implementing a contact investigation and reporting the results of that investigation to the DOH TB. When a case has completed his/her course of therapy, determination of DOT status, completion and effectiveness of therapy, type of health care provider who managed the case, and reason for case closure are reported to the state.

DOH TB staff reviews all case reports for completeness as well as performs follow-ups on missing or incomplete data. Each case report is classified as not a case, suspect, or case. Suspects are continuously followed up by DOH TB staff until such time as they can be reclassified as cases or non-cases. Each week the TB Program counts the number of new, confirmed cases identified in each county in Washington. All surveillance information, except names, is subsequently reported to the CDC every Monday. The CDC compiles a national profile of TB for the purposes of accurately enumerating cases, monitoring adherence to recommended therapy protocols, calculating completion of therapy and directly observed therapy, and monitoring resistance to anti-tuberculosis medications.

Through the process of suspect reporting, determination of case status, and case counting, the true number of individuals with tuberculosis is confirmed and an accurate demographic, risk, and outcome profile of those persons can be outlined.

Data Quality and Limitations

The complex surveillance system for tuberculosis involves the efforts of many individuals at many levels of patient care and management at many times during the course of therapy, which can last more than a year. The data gathered and sent to DOH TB can have variations in some of the elements reported, depending upon the interpretation of the data field by the person completing the TB case report, e.g. misclassification of persons in the wrong race or ethnic category. Ideally, data would be reported correctly and consistently by all parties involved but in any surveillance system this ideal is difficult to achieve. The data elements reported in the Tuberculosis Epidemiologic Profile are considered to be of high quality. In 2004, DOH TB initiated a data-cleaning program and began reviewing cases counted in 2002. Data quality checks for the future include quarterly reports that will be generated on cases with missing or incorrect data. The cases will then be investigated and their data revised. It is hoped that this new quality improvement mechanism will reduce the number of questionable data elements.